The Big Handbook of Nature Study

by Anna Botsford Comstock

Part Three

Reptiles, Amphibians and Mammals

THE BIG HANDBOOK OF NATURE STUDY

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III. BATRACHIAN STUDY

THE COMMON TOAD

Teacher's Story

"*The toad hopped by us with jolting springs.*"—AKERS.

WHOEVER has not had a pet toad has missed a most entertaining experience. Toad actions are surprisingly interesting; one of my safeguards against the blues is the memory of the thoughtful way one of my pet toads rubbed and patted its stomach with its little hands after it had swallowed a June-bug. Toads do not make warts upon attacking hands, neither do they rain down nor are they found in the bed-rock of quarries; but they do have a most interesting history of their own, which is not at all legendary, and which is very like a life with two incarnations.

The mother toad lays her eggs in May and June in ponds, or in the still pools, along streams; the eggs are laid in long strings of jellylike substance, and are dropped upon the pond bottom or attached to water weeds; when first deposited, the jelly is transparent and the little black eggs can be plainly seen; but after a day or two, bits of dirt accumulate upon the jelly, obscuring the eggs. At first the eggs are spherical, like tiny black pills, but as they begin to develop, they elongate and finally the tadpoles may be seen wriggling in the jelly mass, which affords them efficient protection. After four or five days, the tadpoles usually work their way out and swim away; at this stage, the only way to detect the head, is by the direction of the tadpole's progress, since it naturally goes head first. However, the head soon becomes decidedly larger, although at first it is not provided with a mouth; it has instead, a V-shaped elevation where the mouth should be, which forms a sucker secreting a sticky substance by means of which the tadpole attaches itself to water weeds, resting head up. When two or three days old, we can detect little tassels on either side of the throat, which are the gills by which the little creature breathes; the blood passes through these gills, and is purified by coming in contact with the air which is mixed in the water. About ten days later, these gills disappear beneath a membrane which grows down over them; but they are still used for breathing, simply having changed position from the outside to the inside of the throat. The water enters the nostrils to the mouth, passes through an opening in the throat and flows over the gills and out through a little opening at the left side of the body; this opening or breathing-pore, can be easily seen in the larger tadpoles; and when the left arm develops, it is pushed out through this convenient orifice.

When about ten days old, the tadpole has developed a small, round mouth which is constantly in search of something to eat, and at the same time constantly opening and shutting to take in air for the gills; the mouth is provided with horny jaws for biting off pieces of plants. As the

tadpole develops, its mouth gets larger and wider and extends back beneath the eyes, with a truly toadlike expansiveness.

At first, the tadpole's eyes are even with the surface of the head and can scarcely be seen, but later they become more prominent and bulge like the eyes of the adult toad.

The tail of the tadpole is long and flat, surrounded by a fin, thus making an organ for swimming. It strikes the water, first this side and then that, making most graceful curves, which seem to originate near the

Toad's eggs.
Photo by Verne Morton.

body and multiply toward the tip of the tail. This movement propels the tadpole forward, or in any direction. The tail is very thin when seen from above; and it is amusing to look at a tadpole from above, and then at the side; it is like squaring a circle.

There is a superstition that tadpoles eat their tails; and in a sense this is true, because the material that is in the tail is absorbed into the growing body; but the last thing a right-minded tadpole would do, would be to bite off its own tail. However, if some other tadpole should bite off the tail or a growing leg, these organs conveniently grow anew.

When the tadpole is a month or two old, depending upon the species, its hind legs begin to show; they first appear as mere buds which finally push out completely. The feet are long and provided with five toes, of which the fourth is the longest; the toes are webbed so that they may be used to help in swimming. Two weeks later the arms begin to appear, the left one pushing out through the breathing-pore. The "hands" have four fingers and are not webbed; they are used in the water for balancing; while the hind legs are used for pushing, as the tail becomes smaller.

As the tadpole grows older, not only does its tail become shorter but its actions change. It now comes often to the surface of the water in order to get more air for its gills, although it lacks the frog tadpole's nice adjustment of the growing lungs and the disappearing gills. At last some fine rainy day, the little creature feels that it is finally fitted to live the life of a land animal. It may not be a half inch in length, with big head, attenuated body and stumpy tail, but it swims to the shore, lifts itself on its front legs, which are scarcely larger than pins, and walks off, toeing in, with a very grown up air, and at this moment, the tadpole attains toadship. Numbers of them come out of the water together, hopping hither and thither with all of the eagerness and vim of untried youth. It is when issuing thus in hordes from the water and seen by the ignorant, that they gain the reputation of being rained down, when they really were rained up. It is quite impossible for a beginner to detect the difference between the toad and the frog tadpole; usually those of the toads are black, while those of the frogs are otherwise colored, though this is not an invariable distinction. The best way to distinguish the two is to get the eggs and develop the two families separately.

The general color of the common American toad is extremely variable. It may be yellowish-brown, with spots of lighter color, and with reddish or yellow warts. There are likely to be four irregular spots of dark color along each side of the middle of the back, and the under parts are light colored, often somewhat spotted. The throat of the male toad is black and he is not so bright in color as is the female. The warts upon the back are glands, which secrete a substance disagreeable for the animal seeking toad dinners. This is especially true of the glands in the elongated swelling or wart, above and just back of the ear, which is called the parotid gland; these give forth a milky, poisonous substance when the toad is seized by an enemy, although the snakes do not seem to mind it. Some people have an idea that the toad is slimy, but this is not true; the skin is perfectly dry. The toad feels cold to the hand because it is a cold-blooded animal, which means an animal with blood the temperature of the surrounding atmosphere; while the blood of the warm-blooded animal, has a temperature of its own, which it maintains whether the surrounding air is cold or hot.

The toad's face is well worth study; its eyes are elevated and very pretty, the pupil being oval and the surrounding iris shining like gold. The toad winks in a wholesale fashion, the eyes being pulled down into the head; the eyes are provided with nictitating lids, which rise from below, and are similar to those found in birds. When a toad is sleeping, its eyes do not bulge but are drawn in, so as to lie even with the surface of the head. The two tiny nostrils are black and are easily seen; the ear is a flat, oval spot behind the eye

After a hard winter.
Photo by Cyrus Crosby.

and a little lower down; in the common species it is not quite so large as the eye; this is really the ear-drum, since there is no external ear like ours. The toad's mouth is wide and its jaws are horny; it does not need teeth since it swallows its prey whole.

The toad is a jumper, as may be seen from its long, strong hind legs, the feet of which are also long and strong and armed with five toes that are somewhat webbed. The "arms" are shorter and there are four "fingers" to each "hand;" when the toad is resting, its front feet toe-in, in a comical fashion. If a toad is removed from an earth or moss garden, and put into a white wash-bowl, in a few hours it will change to a lighter hue, and vice versa. This is part of its protective color, making it inconspicuous to the eyes of its enemy. It prefers to live in cool, damp places, beneath sidewalks or piazzas, etc., and its warty upper surface resembles the surrounding earth. If it is disturbed, it will seek to escape by long leaps and acts frightened; but if very much frightened, it flattens out on the ground, and looks so nearly like a clod of earth that it may escape even the keen eyes of its pursuer. When seized by the enemy, it will sometimes "play possum," acting as if it were dead; but when actually in the mouth of the foe, it emits terrified and heart-rending cries.

The toad's tongue is attached to the lower jaw, at the front edge of the mouth; it can thus be thrust far out, and since it secretes a sticky substance over its surface, any insects which it touches adhere, and are drawn back into the mouth and swallowed. It takes a quick eye to see this tongue fly out and make its catch. The tadpole feeds mostly upon vegetable matter, but the toad lives entirely upon small animals, usually insects; it is not particular as to what kind of insects; but because of the situations which it haunts, it usually feeds upon those which are injurious to grass and plants. Indeed, the toad is really the friend of the gardener and farmer, and has been most ungratefully treated by those whom it has befriended. If you doubt that a toad is an animal of judgment, watch it when it finds an earthworm and set your doubts at rest! It will walk around the squirming worm, until it can seize it by the head, apparently knowing well that the horny hooks extending backward from the segments of the worm, are likely to rasp the throat if swallowed the wrong way. If the worm prove a too large mouthful, the toad promptly uses its hands in an amusing fashion to stuff the wriggling morsel down its throat. When swallowing a large mouthful, it closes its eyes; but whether this aids the process, or is merely an expression of bliss, we have not determined. The toad never drinks by taking in water through the mouth, but absorbs it through the skin; when it wishes to drink, it stretches itself out in shallow water and thus satisfies its thirst; it will waste away and die in a short time, if kept in a dry atmosphere.

The toad burrows in the earth by a method of its own, hard to describe. It kicks backward with its strong hind legs, and in some mysterious way, the earth soon covers all excepting its head; then, if an enemy comes along, back goes the head, the earth caves in around it, and where is your toad! It remains in its burrow or hiding place usually during the day, and comes out at night to feed. This habit is an advantage, because snakes are then safely at home and, too, there are many more insects to be found at night. The sagacious toads have discovered that the vicinity of street lights is swarming with insects, and there they gather in

numbers. In winter they burrow deeply in the ground and go to sleep, remaining dormant until the warmth of spring awakens them; then, they come out, and the mother toads seek their native ponds there to lay eggs for the coming generation. They are excellent swimmers; when swimming rapidly, the front legs are laid backward along the sides of the body, so as to offer no resistance to the water; but when moving slowly, the front legs are used for balancing and for keeping afloat.

The song of the toad is a pleasant, crooning sound, a sort of gutteral trill; it is made when the throat is puffed out almost globular, thus forming a vocal sac; the sound is made by the air drawn in at the nostrils and passed back and forth from the lungs to the mouth over the vocal chords, the puffed-out throat acting as a resonator.

The toad has no ribs by which to inflate the chest, and thus draw air into the lungs, as we do when we breathe; it is obliged to swallow the air instead and thus force it into the lungs. This movement is shown in the constant pulsation, in and out, of the membrane of the throat.

As the toad grows, it sheds its horny skin, which it swallows; as this process is usually done strictly in private, the ordinary observer sees it but seldom. One of the toad's nice common qualities is its enjoyment in having its back scratched gently.

The toad has many enemies; chief among these is the snake and in only a lesser degree, crows and also birds of prey.

Reference—The Frog Book, Dickerson; Familiar Life in Field and Forest, Mathews; The Usefulness of the American Toad, U. S. Dept. Agr., Farmers Bulletin, No. 196.

LESSON XLIV

The Tadpole Aquarium

Leading thought—The children should understand how to make the tadpoles comfortable and thus be able to rear them.

Materials—A tin or agate pan or a deep earthenware wash-bowl.

Things to be done—1. Go to some pond where tadpoles live.

2. Take some of the small stones on the bottom and at the sides of the pond lifting them very gently so as not to disturb what is growing on their surface. Place these stones on the bottom of the pan, building up one side higher than the other, so that the water will be more shallow on one side than on the other; a stone or two should project above the water.

3. Take some of the mud and leaves from the bottom of the pond, being careful not to disturb them and place upon the stones.

4. Take some of the plants found growing under water in the pond and plant them among the stones.

5. Carry the pan thus prepared back to the schoolhouse and place it where the sun will not shine directly upon it.

6. Bring a pail of water from the pond and pour it very gently in at one side of the pan, so as not to disarrange the plants; fill the pan nearly to the brim.

7. After the mud has settled and the water is perfectly clear, remove some of the tadpoles, which have hatched in the glass aquarium, and place in the "pond." Not more than a dozen should be put in a pan of this size, since the amount of food and microscopic plants which are on the stones in the mud, will afford food for only a few tadpoles.

8. Every week add a little more mud from the bottom of the pond or another stone covered with slime, which is probably some plant growth. More water from the pond should be added to replace that evaporated.

9. Care should be taken that the tadpole aquarium be kept where the sun will not shine directly upon it for any length of time, because if the water gets too warm the tadpoles will die.

10. Remove the "skin" from one side of a tulip leaf, so as to expose the pulp of the leaf, and give to the tadpoles every day or two. Bits of hard-boiled egg should be given now and then.

Toads' Eggs and Tadpoles

Leading thought—The toad's eggs are laid in strings of jelly in ponds. The eggs hatch into tadpoles which are creatures of the water, breathing by gills, and swimming with a long fin. The tadpoles gradually change to toads, which are air-breathing creatures, fitted for life on dry land.

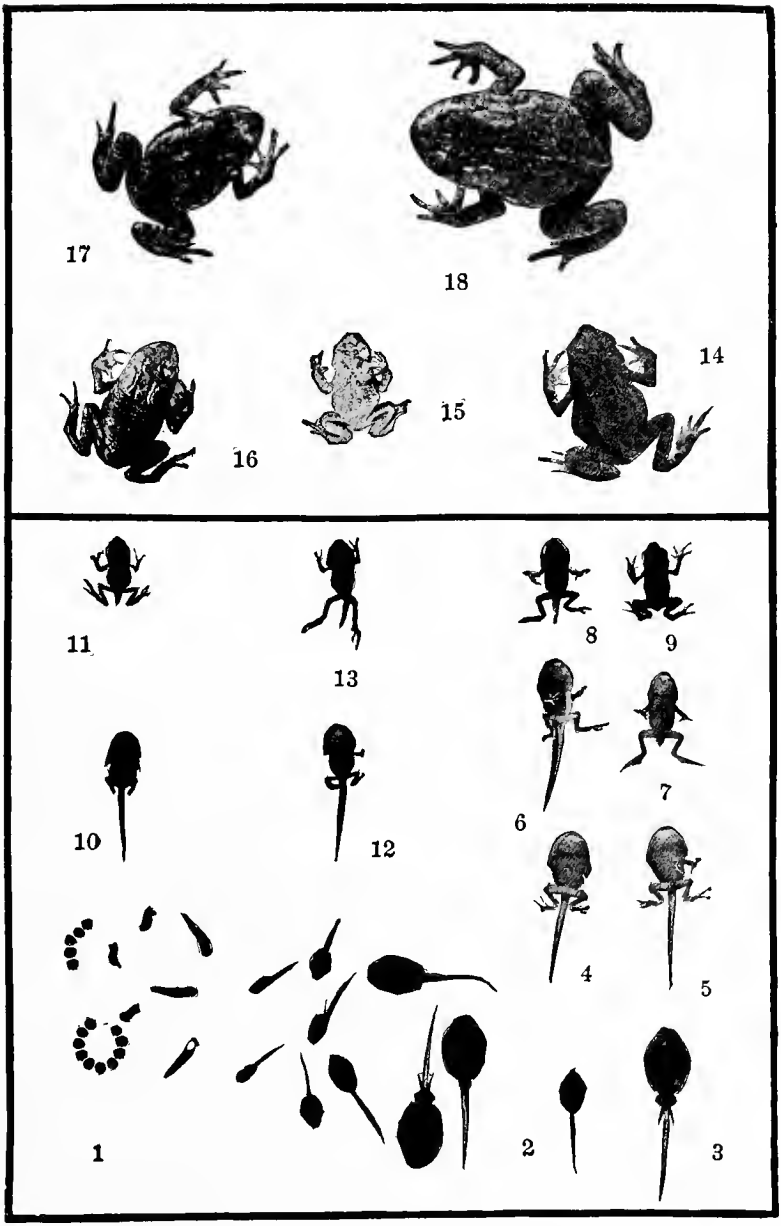
Method—The eggs of toads may be found in almost any pond about the first of May and may be scraped up from the bottom in a scoop-net. They should be placed in the aquarium where the children can watch the stages of development. Soon after they are hatched, a dozen or so should be selected and placed in the tadpole aquarium and the others put back into the stream. The children should observe the tadpoles every day, watching carefully all the changes of structure and habit which take place. If properly fed, the tadpoles will be ready to leave the water in July, as tiny toads.

Observations—1. Where were the toads' eggs found and on what date? Were they attached to anything in the water or were they floating free? Are the eggs in long strings? Do you find any eggs laid in jellylike masses? If so, what are they? How can you tell the eggs of toads from those of frogs?

2. Is the jellylike substance in which the eggs are placed clear or discolored? What is the shape and the size of the eggs? A little later how do they look? Do the young tadpoles move about while they are still in the jelly mass?

3. Describe how the little tadpole works its way out from the jelly covering. Can you distinguish then which is head and which is tail? How does it act at first? Where and how does it rest?

4. Can you see with the aid of a lens the little fringes on each side of the neck? What are these? Do these fringes disappear a little later? Do they disappear on both sides of the neck at once? What becomes of



Toad development in a single season (1903).

1–18, Changes and growth from April to November
1–13 Development in 25 to 60 days
9–14, Different sizes, July 30, 1903
15–18 Different sizes, October 21, 1903
10, 11, The same tadpole, 11 is 47 hours older than 10
12, 13, The same tadpole, 13 is 47 hours older than 12
Photo by S. H. Gage.

them? How does the tadpole breathe? Can you see the little hole on the left side, through which the water used for breathing passes?

5. How does the tail look and how is it used? How long is it in proportion to the body? Describe the act of swimming.

6. Which pair of legs appears first? How do they look? When they get a little larger are they used as a help in swimming? Describe the hind legs and feet.

7. How long after the hind legs appear before the front legs or arms appear? What happens to the breathing-pore when the left arm is pushed through?

8. After both pairs of legs are developed what happens to the tail? What becomes of it?

9. When the tadpole is very young can you see its eyes? How do they look as it grows older? Do they ever bulge out like toads' eyes?

10. As the tadpole gains its legs and loses its tail how does it change in its actions? How does it swim now? Does it come oftener to the surface? Why?

11. Describe the difference between the front and the hind legs and the front and the hind feet on the fully grown tadpole. If the tail or a leg is bitten off by some other creature will it grow again?

LESSON XLV

The Toad

Leading thought—The toad is colored so that it resembles the soil and thus escapes the observation of its enemies. It lives in damp places and eats insects, usually hunting them at night. It has powerful hind legs and is a vigorous jumper.

Method—Make a moss garden in a glass aquarium jar thus: Place some stones or gravel in the bottom of the jar and cover with moss. Cover the jar with a wire screen. The moss should be deluged with water at least once a day and the jar should be placed where the direct sunlight will not reach it. In this jar, place the toad for study.

Observations—1. Describe the general color of the toad above and below. How does the toad's back look? Of what use are the warts on its back?

2. Where is the toad usually found? Does it feel warm or cold to the hand? Is it slimy or dry? The toad is a cold-blooded animal, what does this mean?

3. Describe the eyes and explain how their situation is of special advantage to the toad. Do you think it can see in front and behind and above all at the same time. Does the bulge of the eyes help in this? Note the shape and color of the pupil and iris. How does the toad wink?

4. Find and describe the nostrils. Find and describe the ear. Note the swelling above and just back of the ear. Do you know the use of this?

5. What is the shape of the toad's mouth? Has it any teeth? Is the toad's tongue attached to the front or the back part of the mouth? How is it used to catch insects?

6. Describe the "arms and hands." How many "fingers" on the "hand?" Which way do the fingers point when the toad is sitting down?

7. Describe the legs and feet. How many toes are there? What is the relative length of the toes and how are they connected? What is this web between the toes for? Why are the hind legs so much larger than the front legs?

8. Will a toad change color if placed upon different colored objects? How long does it take it to do this? Of what advantage is this to the toad?

9. Where does the toad live? When it is disturbed how does it act? How far can it jump? If very frightened does it flatten out and lie still? Why is this?

10. At what time does the toad come out to hunt insects? How does it catch the insect? Does it swallow an earthworm head or tail first? When swallowing an earthworm or large insect, how does it use its hands? How does it act when swallowing a large mouthful?

11. How does the toad drink? Where does it remain during the day? Describe how it burrows into the earth.

12. What happens to the toad in the winter? What does it do in the spring? Is it a good swimmer? How does it use its legs in swimming?

13. How does the toad look when croaking? What sort of a noise does it make?

14. Describe the action of the toad's throat when breathing. Did you ever see a toad shed its skin?

15. What are the toad's enemies? How does it act when caught by a snake? Does it make any noise? Is it swallowed head or tail first? What means has it of escaping or defending itself from its enemies?

16. How is the toad of great use to the farmer and gardener?

References—"The Life History of the Toad," by S. H. Gage, Cornell Nature-Study Volume; The Frog Book, Dickerson.

Supplementary reading—"K'dunk, the fat one," A Little Brother to the Bear, Long.

"In the early years we are not to teach nature as science, we are not to teach it primarily for method or for drill: we are to teach it for loving—and this is nature-study. On these points I make no compromise."

—L. H. Bailey.

THE TREE-FROG, OR TREE-TOAD

Teacher's Story

"Ere yet the earliest warbler wakes, of coming spring to tell,
From every marsh a chorus breaks, a choir invisible,
As if the blossoms underground, a breath of utterance had found."—TABB.

ASSOCIATED with the first songs of robin and bluebird, is the equally delightful chorus of the spring peepers, yet how infrequently do most of us see a member of this invisible choir! There are some creatures which are the quintessence of the slang word "cute" which, interpreted, means the pefection of Lilliputian proportions, permeated with undaunted spirit. The chickadee is one of these, and the tree-frog is another. I confess to a thrill of delight when the Pickering's hyla lifts itself on its tiny front feet, twists its head knowingly, and turns on me the full gaze of its bronze-rimmed eyes. This is the tiniest froglet of them all, being little more than an inch long when fully grown; it wears the Greek cross in darker color upon its back, with some stripes across its long hind legs which join the pattern on the back when the frog is "shut up," as the boys say.

The reason we see so little of tree-frogs, is because they are protected from discovery by their color. They have the chameleon power of changing color to match their background. The Pickering's hyla will effect this change in twenty minutes; in this species, the darker lines forming the cross change first, giving a mottled appearance which is at once protective. I have taken three of these peepers, all of them pale yellowish brown with gray markings, and have placed one upon a fern, one on dark soil and one on the purple bud of a flower. Within half an hour, each matched its surroundings so closely, that the casual eye would not detect them. The song of the Pickering's hyla is a resonant chirp, very stirring when heard nearby; it sounds somewhat like the note of a water bird. How such a small creature can make such a loud noise, is a mystery. The process, however, may be watched at night by the light of a lamp, as none of the tree-frogs seem to pay any attention to an artificial light; the thin membrane beneath the throat swells out until it seems almost large enough to balloon the little chap off his perch. No wonder that, with such a sounding-sac, the note is stirring. There are several species of tree-frogs that trill in the branches

Sitting for their pictures. Pickering's Hyla.
Photo by Cyrus Crosby.

above our heads all summer, and their songs are sometimes mistaken for those of the cicada, which is far more shrill.

The tree-frogs have toes and fingers ending in little round discs which secrete at will a substance by means of which they can cling to vertical surfaces, even to glass. In fact, the way to study these wonderful feet is when the frog is climbing up the sides of the glass jar. The fingers are arranged, two short inside ones, a long one, and another short one outside. The hind feet have three shorter inside toes quite far apart, a long one at the tip of the foot and a shorter one outside. When climbing a smooth surface like glass, the toes are spread wide apart, and there are other little clinging discs on their lower sides, although not so large as those at the tips. It is by means of these sticky, disc-like toes that the tree-frogs hold themselves upon the tree trunks.

The whole body of the tree-frog is covered with little tubercles, which give it a roughened appearance. The eyes are black with the iris of reddish color. The tongue is like that of other frogs, hinged to the front of the lower jaw; it is sticky and can be thrust far out to capture insects, of which the tree-frogs eat vast numbers.

The hylas breathe by the rapid pulsation of the membrane of the throat, which makes the whole body tremble. The nostrils are two tiny holes on either side of the tip of the snout. The ears are a little below and just behind the eyes, and are in the form of a circular slit.

The eggs of the spring peepers are laid in ponds during April; each egg has a little globe of jelly about it and is fastened to a stone or a water plant. The tadpoles are small and delicate; the under side of the body is reddish and shines with metallic lustre. These tadpoles differ from those of other frogs in that they often leave the water while yet the tail is still quite long. In summer, they may be found among the leaves and moss around the banks of ponds. They are indefatigable in hunting for gnats, mosquitoes and ants; their destruction of mosquitoes, as pollywogs and as grown up frogs, renders them of great use to us. The voice of this peeper may be heard among the shrubs and vines or in trees during late summer and until November. The little creatures sleep beneath moss and leaves during the winter, waking to give us the earliest news of spring.

Tree-frog tadpoles.

LESSON XLVI

The Tree-frog or Tree-toad

Leading thought—The prettiest part of the spring chorus of the frog ponds is sung by the tree-frogs. These little frogs have the tips of their toes specially fitted for climbing up the sides of trees.

Method—Make a moss garden in an aquarium jar or a two-quart can. Place stones in the bottom and moss at one side, leaving a place on the other side for a tiny pond of water. In this garden place a tree-frog and cover the jar with mosquito netting and place in the shade. The frogs may be found by searching the banks of a pond at night with a lantern. However, this lesson is usually given when by accident the tree-frog is discovered. Any species of tree-frog will do; but the Pickering's hyla, known everywhere as the spring peeper, is the most interesting species to study.

Observations—1. How large is the tree-frog? What is its color? Describe the markings.

2. Place the tree-frog on some light-colored surface like a piece of white blotting paper. Note if it changes color after a half hour. Later place it upon some dark surface. Note if it changes color again. How does this power of changing color benefit the tree-frog? Place a tree-frog on a piece of bark. After a time is it noticeable?

3. Describe the eyes. Note how little the tree-frog turns its head to see anything behind it. Describe its actions if its attention is attracted to anything. What color is the pupil? The iris?

4. Note the movement of breathing. Where does this show the most? Examine the delicate membrane beneath the throat. What has this to do with the breathing?

5. What is the tree-frog's note? At what time of day does it peep? At what time of year? Describe how the frog looks when peeping.

6. How does the tree-frog climb? When it is climbing up a vertical surface study its toes. How many on the front foot? How are they arranged? How many toes on the hind foot? Sketch the front and hind feet. How do the toe-discs look when pressed against the glass? How does it manage to make the discs cling and then let go? Are there any more discs on the under side of the toes? Is there a web between the toes of the hind feet? Of the front feet?

7. Look at a tree-frog very closely and describe its nostrils and its ears.

8. Are the tree-frogs good jumpers? What is the size and length of the hind legs as compared with the body?

9. When and where are the eggs of the tree-frog laid? How do they look?

10. How do the tree-frog tadpoles differ from other tadpoles? Describe them if you have ever seen them. In what situations do they live?

11. Of what use are the tree-frogs to us?

References—"The Life History of the Toad," Cornell Nature Study Volume, S. H. Gage; The Frog Book, Dickerson; Familiar Life of Field and Forest, Mathews; American Natural History, Hornaday; Elementary Zoology, V. L. Kellogg; From River Ooze to Tree-top, Sharp.

Bullfrog.

THE FROG

Teacher's Story

THE stroller along brooksides, is likely to be surprised some day, at seeing a bit of moss and earth suddenly make a high leap and a far one, without apparent provocation. An investigation resolves the clump of moss into a brilliantly green and yellow, striped frog, and then the stroller wonders how he could have overlooked such an obvious creature. But the leopard frog is only obvious when it is out of its environment. The common green frog is quite as well protected since its color is exactly that of green pools. Most frogs spend their lives in or about water, and if caught on land, they make great leaps to reach their native element; the leopard frog and a few other species sometimes wander far afield.

In form, the frog is more slim than the toad, and is not covered with great warts; it is cold and slippery to the touch. The frog's only chance of escaping its enemies, is through the slipperiness of its body and by making long, rapid leaps. As a jumper, the frog is much more powerful than the toad because its hind legs are so much larger and more muscular, in comparison with its size. The first toe in the front feet of the leopard frog is much swollen, making a fat thumb; the mechanics of the hind legs make it possible for the frog to feather the webbed feet as it swims. On the bottom of the toes are hardened places at the joints, and sometimes others besides, which give the foot a strong hold when pushing for the jump. The toe tips, when they are pressed against the glass, resemble slightly the tree-toads' discs. The hind foot is very long, while on the front foot the toes radiate almost in a circle. The foot and leg are colored like the back of the body above, and on the under side resemble the under parts.

The frog is likely to be much more brightly colored than the toad, and usually has much of green and yellow in its dress. But the frog lives among green things, while it is to the toad's advantage to be the color of the soil. Frogs also have the chameleon power of changing color, to harmonize with their environment. I have seen a very green leopard frog change to a slate-gray when placed upon slate-colored rock. The change took place in the green portions. The common green frog will likewise change to slate-color, in a similar situation. A leopard frog changed quickly from dark green to pale olive, when it was placed in the water after having been on the soil.

The eyes of frogs are very prominent, and are beautiful when observed closely. The green frog has a dark bronze iris with a gleaming gold edge around the pupil, and around the outer margin. The eye of the leopard frog is darker; the iris seems to be black, with specks of ruddy gold scattered through it, and there is an outer band of red-gold around the margin. When the frog winks, the nictitating membrane rises from below and covers the whole eye; and when the frog makes a special effort of any sort, it has a comical way of drawing its eyes back into its head. When trying to hide at the bottom of the aquarium, the leopard species lets the eye-lids fall over the eyes, so that they do not shine up and attract pursuers.

The ear is in a similar position to that of the toad, and in the bullfrog, is larger than the eye. In the green frog, it is a dull grayish disc, almost as large as the eye. In the leopard frog, it is not so large as the eye, and has a giltish spot at the center.

The nostrils are small and are closed when below the water, as may be easily seen by a lens. The mouth opens widely, the corners extending back under the eye. The jaws are horny and are armed with teeth, which are for the purpose of biting off food rather than for chewing it. When above water, the throat keeps up a rythmic motion which is the process of breathing; but when below water this motion ceases. The food of frogs is largely composed of insects, that frequent damp places or that live in the water.

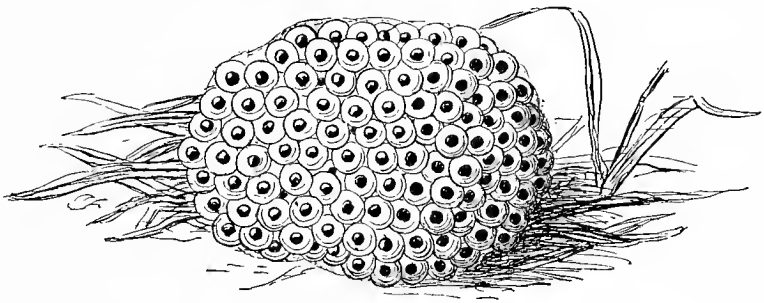
The sound-sacs of the frogs, instead of being beneath the throat, as is the case with toads and tree-frogs, are at the side of the throat; and when inflated, may extend from just back of the eyes, out above the front legs. The song is characteristic, and pleasant to listen to, if not too close by. Perhaps exception should be made to the lay of the bullfrog, which like the song of some noted opera singers, is more wonderful than musical; the boom of the bullfrog makes the earth fairly quake. If we seize the frog by the hind leg, it will usually croak and thus demonstrate for us, the position of its sound-sacs.

In addition to the snakes, the frogs have inveterate enemies in the herons which frequent shallow water, and eat them in great numbers. The frogs hibernate in mud and about ponds, burrowing deep enough to escape freezing. In the spring, they come up and sing their spring songs and the mother frogs lay their eggs in masses of jelly on the bottom of the pond, usually where the water is deeper than in the situations where the toads' eggs are laid. The eggs of the two can always be distinguished, since the toads' are laid in strings of jelly, while the frogs' are laid in masses.

It is amusing to watch with a lens, the frog tadpoles seeking for their microscopic food along the glass of the aquarium. There are horny

upper and lower jaws, the latter being below and back of the former. The upper jaw moves back and forth slightly and rythmically, but the dropping of the lower jaw opens the mouth. There are three rows of tiny black teeth below the mouth and one row above; at the sides and below these teeth are little, finger-like fringes. Fringes, rows of teeth and jaws all work together, up and down, out and in, in the process of breathing. The nostrils, although minute, are present in the tadpole in its early stages. The pupil of the eye is almost circular and the iris is usually yellow or copper-bronze, with black mottling. The eyes do not wink nor withdraw. The breathing-pore on the left side, is a hole in a slight protuberance.

At first, the tadpoles of the frogs and toads are very much alike; but later, most of the frog tadpoles are lighter in color, usually being olive-green, mottled with specks of black and white. The frog tadpoles usually remain much longer than the toads in the tadpole stage, and when finally they change to adults, they are far larger in size than the toads are, when they attain their jumping legs.



Frog's eggs.

LESSON XLVII

The Frog

Leading thought—The frog lives near or in ponds or streams. It is a powerful jumper and has a slippery body. Its eggs are laid in masses of jelly at the bottom of ponds.

Method—The frog may be studied in its native situation by the pupils or it may be brought to the school and placed in an aquarium; however, to make a frog aquarium there needs to be a stick or stone projecting above the water, for the frog likes to spend part of the time entirely out of water or only partially submerged.

Observations—1. Where is the frog found? Does it live all its life in the water? When found on land how and where does it seek to escape?

2. Compare the form of the frog with that of the toad. Describe the skin, its color and texture. Compare the skin of the two.

3. Describe the colors and markings of the frog on the upper and on the under side. How do these protect it from observation from above? From below? How do we usually discover that we are in the vicinity of a frog?

4. Describe the frog's ears, eyes, nostrils and mouth.

5. Compare its "hands and feet" with those of the toad. Why the difference in the hind legs and feet?

6. How does the frog feel to your hand? Is it easy to hold him? How does this slipperiness of the frog benefit it?

7. On what does the frog feed? What feeds on it? How does it escape its enemies?

8. What sounds does the frog make? Where are its sound sacs located? How do they look when they are inflated?

9. Is the frog a good swimmer? Is it a better jumper than the toad? Why?

10. Where are the frog's eggs laid? How do they look?

11. Can you tell the frog tadpoles from those of the toad? Which remains longer in the tadpole stage? Study the frog tadpoles, following the questions given in Lesson XLIV.

12. What happens to the frog in winter?

FESTINA LENTE

Once on a time there was a pool
Fringed all about with flag-leaves cool
And spotted with cow-lilies garish,
Of frogs and pouts the ancient parish.
Alders the creaking redwings sink on,
Tussocks that house blithe Bob o' Lincoln,
Hedged round the unassailed seclusion,
Where muskrats piled their cells Carthusian;
And many a moss-embroidered log,
The watering-place of summer frog,
Slept and decayed with patient skill,
As watering-places sometimes will.
Now in this Abbey of Theleme,
Which realized the fairest dream
That ever dozing bull-frog had,
Sunned, on a half-sunk lily pad,
There rose a party with a mission
To mend the polliwog's condition,
Who notified the selectmen
To call a meeting there and then.
"Some kind of steps," they said, "are needed;
They don't come on so fast as we did:
Let's dock their tails; if that don't make 'em
Frogs by brevet, the Old One take 'em!
That boy, that came the other day
To dig some flag-root down this way,
His jack-knife left, and 'tis a sign
That Heaven approves of our design:
'T were wicked not to urge the step on,
When Providence has sent the weapon."
Old croakers, deacons of the mire,
That led the deep batrachian choir,
"Uk! Uk! Caronk!" with bass that might
Have left Lablache's out of sight,
Shook nobby heads, and said "No, go!
You'd better let 'em try to grow:
Old Doctor Time is slow, but still
He does know how to make a pill."
But vain was all their hoarsest bass,
Their old experience out of place,
And spite of croaking and entreating
The vote was carried in marsh-meeting.
"Lord knows," protest the polliwogs,
"We're anxious to be grown-up frogs;
But don't push in to do the work
Of Nature till she prove a shirk;
'Tis not by jumps that she advances,
But wins her way by circumstances;
Pray, wait awhile, until you know
We're so contrived as not to grow;
Let Nature take her own direction,
And she'll absorb our imperfection;
You mightn't like 'em to appear with,
But we must have the things to steer with."
"No," piped the party of reform,
"All great results are ta'en by storm;
Fate holds her best gifts till we show
We've strength to make her let them go;
The Providence that works in history,
And seems to some folks such a mystery,
Does not creep slowly on, incog.,
But moves by jumps, a mighty frog;
No more reject the Age's chrism,
Your queues are an anachronism;
No more the future's promise mock,
But lay your tails upon the block,
Thankful that we the means have voted
To have you thus to frogs promoted."
The thing was done, the tails were cropped,
And home each philotadpole hopped,
In faith rewarded to exult,
And wait the beautiful result.
Too soon it came; our pool, so long
The theme of patriot bull-frog's song,
Next day was reeking, fit to smother,
With heads and tails that missed each other,—
Here snoutless tails, there tailless snouts;
The only gainers were the pouts.

MORAL

From lower to the higher next,
Not to the top is Nature's text;
And embryo Good, to reach full stature,
Absorbs the Evil in its nature.

—Lowell

THE NEWT, EFT, OR SALAMANDER

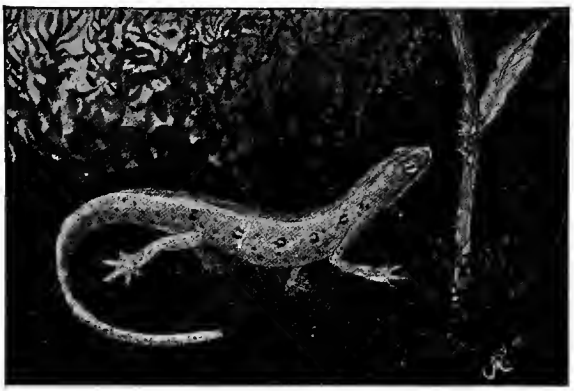
Teacher's Story

AFTER a rain in spring or summer, we see these little orange-red creatures sprawling along roads or woodland paths, and since they are rarely seen except after rain, the wise people of old, declared they rained down, which was an easy way for explaining their presence. But the newts do not rain down, they rain up instead, since if they have journeys to make they must needs go forth when the ground is wet, otherwise they would dry up and die. Thus, the newts make a practice of never going out except when it rains. A closer view of the eft shows plenty of peculiarities in its appearance to interest us. Its colors are decidedly gay, the body color being orange, ornamented with vermilion dots along each side of the back, each red dot margined with tiny black specks; but the eft is careless about these decorations and may have more spots on one side than on the other. Besides these vermilion dots, it is also adorned with black specks here and there, and especially along its sides looks as if it had been peppered. The newt's greatest beauty lies in its eyes; these are black, with elongated pupils, almost parallel with the length of the head, and bordered above and below with bands of golden, shining iris which give the eyes a fascinating brilliancy. The nostrils are mere pinholes in the end of the snout.

The legs and feet look queerly inadequate for such a long body, since they are short and far apart. There are four toes on the front feet and five on the hind feet, the latter being decidedly pudgy. The legs are thinner where they join the body and wider toward the feet. The eft can move very rapidly with its scant equipment of legs. It has a misleading way of remaining motionless for a long time and then darting forward like a flash, its long body falling into graceful curves as it moves. But it can go very slowly when exploring; it then places its little hands cautiously and lifts its head as high as its short arms will allow, in order to take observations. Although it can see quite well, yet on an unusual surface, like glass, it seems to feel the way by touching its lower lip to the surface as if to test it. The tail is flattened at the sides and is used to twine around objects in time of need; and I am sure it is also used to push the eft while crawling, for it curves this way and that vigorously, as the feet progress, and obviously pushes against the ground. Then, too, the tail is an aid when, by some chance, the eft is turned over on its back, for with its help, it can right itself speedily. The eft's method of walking is interesting; it moves forward one front foot and then the hind foot on the other side; after a stop for rest, it begins just where it left off when it again starts on. Its beautiful eyes seem to serve the newt well indeed, for I find that, when it sees my face approaching the moss jar, it climbs promptly over to the other side. There are no eyelids for the golden eyes, but the eft can pull them back into its head and close the slit after them, thus making them very safe.

The eft with whose acquaintance I was most favored, was not yet mature and was afraid of earthworms; but he was very fond of plant-lice and it was fun to see the little creature stalking them. A big rose plant-louse would be squirming with satisfaction as it sucked the juice of the leaf, when the eft would catch sight of it and become greatly

excited, evidently holding his breath since the pulsating throat would become rigid. There was a particularly alert attitude of the whole front part of the body and especially of the eyes and the head; then the neck would stretch out long and thin, the orange snout approach stealthily within half an inch of the smug aphid, and then there was a flash as of lightning, something too swift to see coming out of the eft's mouth and swooping up the unsuspecting louse. Then there would be a gulp or two and all would be over. If the aphid happened to be a big one, the eft made visible effort to swallow it. Sometimes his eftship would become greatly excited when he first saw the plant-louse, and he would sneeze and snort in a very comical way, like a dog, when eager for game.



Red-spotted newt stalking plant-lice.

The following is the history of this species as summarized from Mrs. S. H. Gage's charming "Story of Little Red Spot." The egg was laid in some fresh water pond or the still borders of some stream where there is a growth of water weed. The egg, which is about the size of a small pea, is fastened to a water plant. It is covered with a tough but translucent envelope, and has at the center a little yellowish globule. In a little less than a month the eft hatches, but it looks very different from the form with which we are most familiar. It has gray stripes upon its sides and three tiny bunches of red gills on each side, just back of its broad head. The tail is long and very thin, surrounded by a fin; it is an expert swimmer and breathes water as does a fish. After a time, it becomes greenish above and buff below, and by the middle of August it develops legs and has changed its form so that it is able to live upon land; it no longer has gills or fin; soon the coat changes to the bright orange hue which makes the little creature so conspicuous.

The newt usually keeps hidden among moss, or under leaves, or in decaying wood, or other damp and shady places; but after a rain, when the whole world is damp, it feels confidence enough to go out in the open, and hunt for food. For two and a half years it lives upon land and then returns to the water. When this impulse comes upon it, it may be far from any stream; but it seems to know instinctively where to go. Soon after it enters the water, it is again transformed in color, becoming olive-green above and buff below, although it still retains the red spots along the back, as mementos of its land life; and it also retains its pepper-like dots. Its tail develops a fin which extends along its back and is somewhat ruffled. In some mysterious way it develops the power to again breathe the air which is mixed with water.

The male has the hind legs very large and flat; the female is lighter in color and has more delicate and smaller legs. It is here in the water that the efts find their mates and finish careers which must have surely been hazardous. During its long and varied life, the eft often sheds its skin like the snake; it has a strange habit of swallowing its cast-off coat.

LESSON XLVIII

The Newt, Eft, or "Salamander"

Leading thought—The newts change their form three times to fit different modes of life. They are born in the water and at first have fins and gills like fishes. They then live on land, and have lungs for breathing air and lose their fins; later they go back to the water and again develop the power of breathing the oxygen contained in water, and also a fin.

Early stage of vermilion-spotted newt. Eggs of newt attached to water plant. Drawn by Anna Stryke.

Method—The little, orange eft or red-spotted salamander may be kept in an aquarium which has in it an object, as a stone or a clump of moss which projects above the water. For food it should be given small earthworms or leaves covered with plant lice. In this way it may be studied at leisure.

Observations—1. Look at the eft closely. Is it all the same color? How many spots upon its back and what colors are they? Are there the same number of spots on both sides? Are there any spots or dots besides these larger ones? How does the eft resemble a toad?

2. Is the head the widest part of the body? Describe the eyes, the shape and color of the pupil and of the iris. How does the eft wink? Do you think it can see well?

3. Can you see the nostrils? How does the throat move and why?

4. Are both pairs of legs the same size? How many toes on the front feet? How many toes on the hind feet? Does the eft toe-in with its front feet like a toad?

5. Does it move more than one foot at a time when walking? Does it use the feet on the same side in two consecutive steps? After putting forward the right front foot what foot follows next? Can it move backward?

6. Is the tail as long as the head and body together? Is the tail round or flat at the sides? How is it used to help the eft when traveling? Does the tail drag or is it lifted, or does it push by squirming?

7. How does the eft act when startled? Does it examine its surroundings? Do you think it can see and is afraid of you?

8. Why do we find these creatures only during wet weather? Why do people think they rain down?

9. What does the eft eat? How does it catch its prey? Does it shed its skin? How many kinds of efts have you seen?

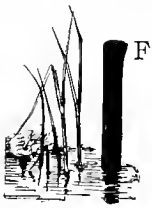
10. From what kind of egg does the eft hatch? When is this egg laid? How does it look? On what is it fastened?

11. How many times during its life does the orange eft change color? What part of its life is spent upon land? What changes take place in its form when it leaves the water for life upon land, and what changes take place in its structure when it returns to the water?

IV. REPTILE STUDY

Yet when a child and barefoot; I more than once, at morn,
Have passed, I thought, a whiplash unbraided in the sun,
When, stooping to secure it, it wrinkled, and was gone.

—Emily Dickinson.



IF the teacher could bring herself to take as much interest as did Mother Eve in that "subtile animal," as the Bible calls the serpent, she might, through such interest, enter the paradise of the boyish heart instead of losing a paradise of her own. How many teachers, who have an aversion for snakes, are obliged to teach small boys whose pet diversion is capturing these living ribbons and bringing them into the schoolroom stowed away not too securely in pockets! In one of the suburban Brooklyn schools, boys of this ilk sought to frighten their teacher with their weird prisoners. But she was equal to the occasion, and surprised them by declaring that there were many interesting things to be studied about snakes, and forthwith sent to the library for books which discussed these reptiles; and this was the beginning of a nature-study club of rare efficiency and enterprise.

There are abroad in the land, many errors concerning snakes. Most people believe that they are all venomous, which is far from true. The rattlesnake still holds its own in rocky, mountainous places and the moccasin haunts the bayous of the southern coast; however, in most localities, snakes are not only harmless but are beneficial to the farmer. The superstition that if a snake is killed, its tail will live until sun-down, is general and has but slender foundation in the fact that snakes, being lower in their nerve-organization than mammals, the process of death is a slow one. Some people firmly believe that snakes spring or jump from the ground to seize their prey, which is quite false since no snake jumps clear of the ground as it strikes, nor does it spring from a perfect coil. Nor are snakes slimy, quite to the contrary, they are covered with perfectly dry scales. But the most general superstition of all is that, when a snake thrusts out its tongue, it is an act of animosity; the fact is, the tongue is a sense organ and is used as an insect uses its feelers or antennae, and the act is also supposed to aid the creature in hearing; thus when a snake thrusts out its tongue, it is simply trying to find out about its surroundings and what is going on.

Snakes are the only creatures able to swallow objects larger than themselves. This is rendered possible by the elasticity of the body walls, and the fact that snakes have an extra bone hinging the upper to the lower jaw, allowing them to spread widely; the lower jaw also separates at the middle of its front edge and spreads apart sidewise. In order to force a creature into a "bag" so manifestly too small, a special mechanism is needed; the teeth supply this by pointing backward, and thus assist in the swallowing. The snake moves by literally walking on the ends of its ribs, which are connected with the crosswise plates on its lower side; each of these crosswise plates has the hind edge projecting down so that it can hold to an object. Thus, the graceful, noiseless progress of the snake, is brought about by many of these crosswise plates worked by the movement of the ribs.

Some species of snakes simply chase their prey, striking at it and catching it in the open mouth, while others, like the black snake, wind themselves about their victims crushing them to death. Snakes can live a long time without food; many instances on record show that they have been able to exist a year or more without anything to eat. In our northern climate they hibernate in winter, going to sleep as soon as the weather becomes cold and not waking up until spring. As snakes grow, they shed their skins; this occurs only two or three times a year. The crested fly-catcher adorns its nest with these phantom snakes.

References—The Reptile Book, by Ditmars, gives interesting accounts of our common snakes; Mathew's Familiar Life of Field and Forest is also valuable. To add interest to the snake lessons let the children read "Kaas Hunting" and "Rikki Tikki Tavi" from Kipling's Jungle Books.

THE GARTER, OR GARDEN, SNAKE

Teacher's Story

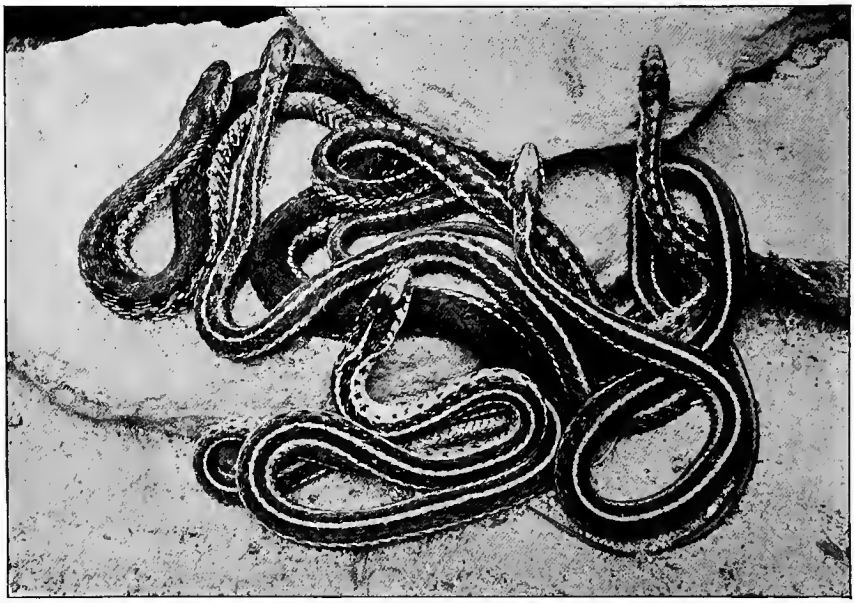
A chipmunk, or a sudden-whirring quail,
Is startled by my step as on I fare.
A gartersnake across the dusty trail,
Glances and — is not there.—RILEY.

GARTER snakes can be easily tamed, and are ready to meet friendly advances half way. A handsome yellow-striped, black garter lived for four years beneath our piazza and was very friendly and unafraid of the family. The children of the campus made it frequent visits, and never seemed to be weary of watching it; but the birds objected to it very much, although it never attempted to reach their nests in the vine above. The garter snakes are the most common of all, in our Northeastern States. They vary much in color; the ground color may be olive, brown or black, and down the center of the back is usually a yellow, green or whitish stripe, usually bordered by a darker band of ground-color. On each side is a similar stripe, but not so brightly colored; sometimes the middle stripe, and sometimes the side stripes are broken into spots or absent; the lower side is greenish white or yellow. When fully grown this snake is about three feet in length.

The garters are likely to congregate in numbers in places favorable for hibernation, like rocky ledges or stony side-hills. Here each snake finds a safe crevice, or makes a burrow which sometimes extends a yard or more under ground. During the warm days of Indian summer, these winter hermits crawl out in the middle of the day and sun themselves, retiring again to their hermitages when the air grows chilly toward night; and when the cold weather arrives, they go to sleep and do not awaken until the first warm days of spring; then, if the sun shines hot, they crawl out and bask in its welcome rays.

After the warm weather comes, the snakes scatter to other localities more favorable for finding food, and thus these hibernating places are deserted during the summer. The banks of streams, and the edges of woods are places which furnish snakes their food, which consists of earthworms, insects, toads, salamanders, frogs, etc. The young are born late

in July and are about six inches long at birth; one mother may have in her brood from eleven to fifty snakelings; she stays with them during the fall to protect them, and there are many stories about the way the young ones run down the mother's throat in case of attack; but, as yet, no scientist has seen this act, or placed it on record. The little snakes shift for their own food, catching small toads, earthworms and insects. If it finds food in plenty, the garter snake will mature in one year. Hawks, crows, skunks, weasels and other predacious animals seem to find the garter snake attractive food.



Garter snakes.

LESSON XLIX

The Garter, or Garden, Snake

Leading thought—The garter snake is a common and harmless little creature and has many interesting habits which are worth studying.

Method—A garter snake may be captured and placed in a box with a glass cover and thus studied in detail in the schoolroom, but the lesson should begin with observations made by the children on the snakes in their native haunts.

Observations—1. What are the colors and markings of your garter snake? Do the stripes extend along the head as well as the body? How long is it?

2. Describe its eyes, its ears, its nostrils and its mouth.

3. If you disturb it how does it act? Why does it thrust its tongue out? What shape is its tongue?

4. In what position is the snake when it rests? Can you see how it moves? Look upon the lower side. Can you see the little plates extending crosswise? Do you think it moves by moving these plates? Let it crawl across your hand, and see if you can tell how it moves.

5. What does the garter snake eat? Did you ever see one swallow a toad? A frog? Did it take it head first or tail first?

6. Where does the garter spend the winter? How early does it appear in the spring?

7. At what time of year do you see the young snakes? Do the young ones run down the throat of the mother for safety when attacked? Does the mother snake defend her young?

8. What enemies has the garter snake?

"No life in earth or air or sky;
The sunbeams, broken silently,
On the bared rocks around me lie,—

Cold rocks with half-warmed lichens scarred,
And scales of moss; and scarce a yard
Away, one long strip, yellow-barred.

Lost in a cleft! 'Tis but a stride
To reach it, thrust its roots aside,
And lift it on thy stick astride!

Yet stay! That moment is thy grace!
For round thee, thrilling air and space,
A chattering terror fills the place!

A sound as of dry bones that stir,
In the dead valley! By yon fir
The locust stops its noon-day whir!

The wild bird hears; smote with the sound.
As if by bullet brought to ground
On broken wing, dips, wheeling round!

The hare, transfixed, with trembling lip,
Halts breathless, on pulsating hip,
And palsied tread, and heels that slip.

Enough, old friend!—'tis thou. Forget
My heedless foot, nor longer fret
The peace with thy grim castanet!"

FROM "CROTALUS" (THE RATTLESNAKE), BRET HARTE.

THE MILK SNAKE, OR SPOTTED ADDER

Teacher's Story

The grass divides as with a comb, a spotted shaft is seen,
And then it closes at your feet, and opens farther on.

—EMILY DICKINSON.

THIS is the snake which is said to milk cows, a most absurd belief; it would not milk a cow if it could, and it could not if it would. It has never yet been induced to drink milk when in captivity; and if it were very thirsty, it could not drink more than two teaspoonfuls of milk at most; thus in any case, its depredations upon the milk supply need not be feared. Its object, in frequenting milk houses and stables, is far other than the milking of cows, for it is an inveterate hunter of rats and mice and is thus of great benefit to the farmer. It is a constrictor, and squeezes its prey to death in its coils.

The ground color of the milk snake is pale gray, but it is covered with so many brown or dark gray saddle-shaped blotches, that they seem rather to form the ground-color; the lower side is white, marked with square black spots and blotches. The snake attains a length of about three feet when fully grown. Although it is called commonly the spotted adder, it does not belong to the adders at all, but to the family of the king snakes.

During July and August, the mother snake lays from seven to twenty eggs; they are deposited in loose soil, in moist rubbish, in compost heaps, etc. The egg is a symmetrical oval in shape and is about one and one-eighth inches long by a half inch in diameter. The shell is soft and white, like kid leather, and the egg resembles a puffball. The young hatch nearly two months after the eggs are laid, meanwhile the eggs have increased in size so that the snakelings are nearly eight inches long when they hatch. The saddle-shaped blotches on the young have much red in them. The milk snake is not venomous; it will sometimes, in defence, try to chew the hand of the captor, but the wounds it can inflict are very slight and heal quickly.

The milk snake, or spotted adder.

LESSON L.

The Milk Snake, or Spotted Adder

Leading thought—The milk snake is found around stables where it hunts for rats and mice but never milks the cows.

Method—Although the snake acts fiercely, it is perfectly harmless and may be captured in the hands and placed in a glass-covered box for a study in the schoolroom.

Observations—1. Where is the milk snake found? Why is it called milk snake? Look at its mouth and see if you think it could possibly suck a cow. See if you can get the snake to drink milk.

2. What does it live upon? How does it kill its prey? Can the milk snake climb a tree?

3. Where does the mother snake lay her eggs? How do the eggs look? How large are they? How long are the little snakes when they hatch from the egg? Are they the same color as the old ones?

4. Describe carefully the colors and markings of the milk snake and explain how its colors protect it from observation. What are its colors on the under side?

5. Have you ever seen a snake shed its skin? Describe how it was done. How does the sloughed-off skin look? What bird always puts snake skins around its nest?

I have the same objection to killing a snake that I have to the killing of any other animal, yet the most humane man I know never omits to kill one.

Aug. 5, 1853.

The mower on the river meadows, when he comes to open his hay these days, encounters some overgrown water adder, full of young (?) and bold in defense of its progeny, and tells a tale when he comes home at night which causes a shudder to run through the village—how it came at him and he ran, and it pursued and overtook him, and he transfixed it with a pitchfork and laid it on a cock of hay, but it revived and came at him again. This is the story he tells in the shops at evening. The big snake is a sort of fabulous animal. It is always as big as a man's arm and of indefinite length. Nobody knows exactly how deadly is its bite but nobody is known to have been bitten and recovered. Irishmen introduced into these meadows for the first time, on seeing a snake, a creature which they have seen only in pictures before, lay down their scythes and run as if it were the Evil One himself and cannot be induced to return to their work. They sigh for Ireland, where they say there is no venomous thing that can hurt you.

—Thoreau's Journal.

THE WATER SNAKE

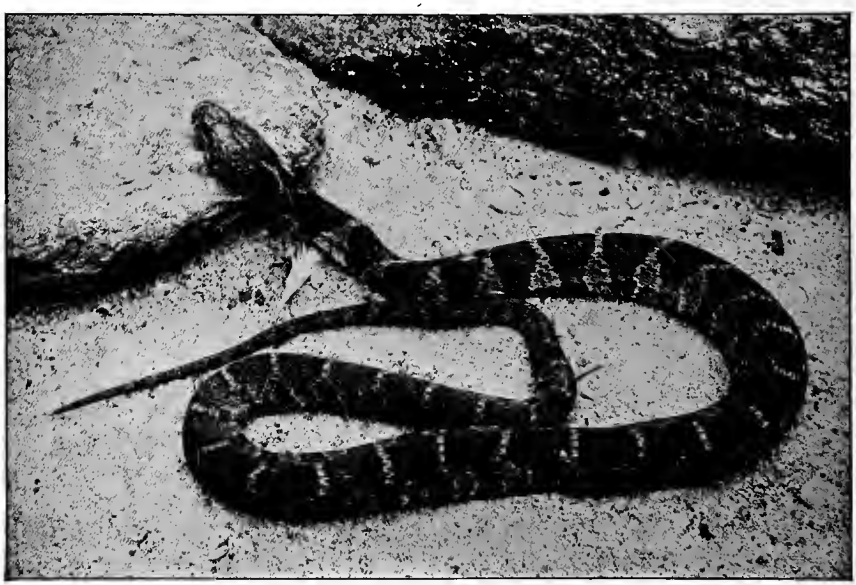
Teacher's Story

EVERY boy that goes fishing, knows the snake found commonly about mill-dams and wharves or on rocks and bushes near the water. The teacher will have accomplished a great work, if these boys are made to realize that this snake is a more interesting creature for study, than as an object to pelt with stones.

The water snake is a dingy brown in color, with cross-bands of brownish or reddish brown which spread out into blotches at the side. Its color is very protective as it lies on stones or logs in its favorite attitude of sunning itself. It is very local in its habits, and generally has a favorite place for basking and returns to it year after year on sunny days.

This snake lives mostly upon frogs and salamanders and fish; however, it preys usually upon fish of small value, so it is of little economic importance. It catches its victims by chasing, and seizing them in its jaws. It has a very keen sense of smell and probably traces its prey in this manner, something as a hound follows a fox. It is an expert swimmer, usually lifting the head a few inches above the water when swimming, although it is able to dive and remain below the water for a short time.

The water snake is a bluffer, and, when cornered, it flattens itself and strikes fiercely. But its teeth contain no poison and it can inflict only slight and harmless wounds. When acting as if it would "rather fight than eat," if given a slight chance to escape, it will flee to the water like a "streak of greased lightning," as any boy will assure you.



The water snake.

The water snake attains a length of about four feet. The young do not hatch from eggs, but are born alive in August and September; they differ much in appearance from their parents as they are pale gray in color, with jet-black cross-bands.

LESSON LI

The Water Snake

Leading thought—The water snake haunts the banks of streams because its food consists of creatures that live in and about water.

Method—If water snakes are found in the locality, encourage the boys to capture one without harming it, and bring it to school for observation. However, as the water snake is very local in its habits, and haunts the same place year after year, it will be better nature-study to get the children to observe it in its native surroundings.

Observations—1. Where is the water snake found? How large is the largest one you ever saw?

2. Why does the water snake live near water? What is its food? How does it catch its prey?

3. Describe how the water snake swims. How far does its head project above the water when swimming? How long can it stay completely beneath the water?

4. Describe the markings and colors of the water snake. How do these colors protect it from observation? How do the young look?

5. Does each water snake have a favorite place for sunning itself?

6. Where do the water snakes spend the winter?

May 12, 1858.

Found a large water adder by the edge of Farmer's large mudhole, which abounds with tadpoles and frogs, on which it was probably feeding. It was sunning on the bank and would face me and dart its head toward me when I tried to drive it from the water. It is barred above, but indistinctly when out of the water, so that it appears almost uniformly dark brown, but in the water, broad, reddish brown bars are seen, very distinctly alternating with very dark-brown ones. The head was very flat and suddenly broader than the neck behind. Beneath, it was whitish and reddish flesh-color. It was about two inches in diameter at the thickest part. The inside of its mouth and throat was pink. They are the biggest and most formidable-looking snakes that we have. It was awful to see it wind along the bottom of the ditch at last, raising wreaths of mud amid the tadpoles, to which it must be a very sea-serpent. I afterward saw another, running under Sam Barrett's grist-mill, the same afternoon. He said that he saw a water-snake, which he distinguished from a black snake, in an apple tree near by, last year, with a young robin in its mouth, having taken it from the nest. There was a cleft or fork in the tree which enabled it to ascend.

—Thoreau's Journal.

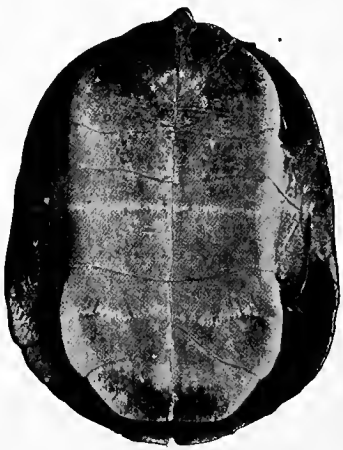
THE TURTLE

Teacher's Story

A TURTLE is at heart a misanthrope; its shell is in itself proof of its owner's distrust of this world. But we need not wonder at this misanthropy, if we think for a moment of the creatures that lived on this earth, at the time when turtles first appeared. Almost any of us would have been glad of a shell in which to retire, if we had been contemporaries of the smilodon and other monsters of earlier geologic times.

When the turtle feels safe and walks abroad for pleasure, his head projects far from the front end of his shell, and the legs, so wide, and soft that they look as if they had no bones in them, project out at the side, while the little, pointed tail brings up an undignified rear; but frighten him and at once head, legs and tail all disappear, and even if we turn him over, we see nothing but the tip of the nose, the claws of the feet and the tail turned deftly sidewise. When frightened, he hisses threateningly; the noise seems to be made while the mouth is shut, and the breath emitted through the nostrils.

Carapace of painted terrapin in retirement.



Plastron of same terrapin.

The upper shell of the turtle is called the carapace and the lower shell, the plastron. There is much difference in the different species of turtles in the shape of the upper shell and the size and shape of the lower one. In most species the carapace is sub-globular but in some it is quite flat. The upper shell is grown fast to the backbone of the animal, and the lower shell to the breast bone. The markings and colors of the shell offer excellent subjects for drawing. The painted terrapin has a red-mottled border to the shell, very ornamental; the wood turtle has a shell made up of plates each of which is ornamented with concentric ridges; and the box-turtle has a front and rear trap-door, hinged to the plastron, which can be pulled up against the carapace when the turtle wishes to retire, thus covering it entirely.

The turtle's head is decidedly snakelike. Its color differs with different species. The wood turtle has a triangular, horny covering on the top of the head, in which the color and beautiful pattern of the shell are repeated; the underparts are brick-red with indistinct yellowish lines under the jaw. The eyes are black with a yellowish iris, which somehow gives them a look of intelligence. The turtle has no eyelids like our own, but has a nictitating membrane which comes up from below and completely covers the eye; if we seize the turtle by the head and attempt to touch its eyes, we can see the use of this eyelid. When the turtle winks, it seems to turn the eyeball down against the lower lid.

The sense of smell in turtles is not well developed, as may be guessed by the very small nostrils, which are mere pin-holes in the snout. The mouth is a more or less hooked beak, and is armed with cutting edges instead of teeth. The constant pulsation in the throat is caused by the turtle swallowing air for breathing.

The turtle's legs, although so large and soft, have bones within them, as the skeleton shows. The claws are long and strong; there are five claws on the front and four on the hind feet. Some species have a distinct web between the toes; in others, it is less marked, depending upon whether the species lives mostly in water or out of it. The color of the turtle's body varies with the species; the body is covered with coarse, rough skin made up of various-sized plates.

Boxy, a trained turtle.
Photo by Silas Lottridge.

The enemies of turtles are the larger fishes and other turtles. Two turtles should never be kept in the same aquarium, since they eat each others' tails and legs with great relish. They feed upon insects, small fish, or almost anything soft-bodied which they can find in the water; they are especially fond of earthworms. The species which frequent the land, feed upon tender vegetation and also eat berries. In an aquarium, a turtle should be fed earthworms, chopped fresh beef, lettuce leaves and berries. The wood turtle is especially fond of cherries.

The aquarium should always have in it a stone or some other object projecting above the water, so that the turtle may climb out, if it chooses. In winter, turtles bury themselves in the ooze at the bottom of ponds and streams. Their eggs have white leathery shells, are oblong or round, and are buried by the mother in the sand or soil near a stream or pond. The long life of turtles is a well authenticated fact, dates carved upon their shells show them to have attained the age of thirty or forty years.

The following are, perhaps, the most common species of turtles:

(a) *The Snapping Turtle*—This sometimes attains a shell 14 inches long and a weight of forty pounds. It is a vicious creature and inflicts a severe wound with its sharp, hooked beak; it should not be used for a nature-study lesson unless the specimen is very young.

(b) *The Mud Turtle*—The musk turtle and the common mud turtle both inhabit slow streams and ponds; they are truly aquatic and only come to shore to deposit their eggs. They cannot eat, unless they are under water, and they seek their food in the muddy bottoms. The musk turtle when handled, emits a very strong odor; it has on each side of the head two broad yellow stripes. The mud turtle has no odor. Its head is ornamented with greenish yellow spots.

(c) *The Painted Terrapin, or Pond Turtle*—This can be determined by the red mottled border of its shell. It makes a good pet, if kept in an aquarium by itself, but will destroy other creatures. It will eat meat or chopped fish, and is fond of earthworms and soft insects.

(d) *The Spotted Turtle*—This has the upper shell black with numerous round yellow spots upon it. It is common in ponds and marshy streams and its favorite perch is, with many of its companions, upon a log. It feeds under water, eating insect larvæ, dead fish and vegetation. It likes fresh lettuce.

(e) *The Wood Terrapin*—This is our most common turtle; it is found in damp woods and wet places, since it lives largely upon the land. Its upper shell often reaches a length of six and one-half inches and is made up of many plates, ornamented with concentric ridges. This is the turtle upon whose shell people carve initials and dates and then set it free. All the fleshy parts of this turtle, except the top of the head and the limbs, are brick-red. It feeds on tender vegetables, berries and insects. It makes an interesting pet and will soon learn to eat from the fingers of its master.

(f) *The Box-Turtle*—This is easily distinguished from the others, because the front and rear portions of the lower shell are hinged so that they can be pulled up against the upper shell. When this turtle is attacked, it draws into the shell and closes both front and back doors, and is very safe from its enemies. It lives entirely upon land and feeds upon berries, tender vegetation and insects. It lives to a great age.

(g) *The Soft-shelled Turtle*—These are found in streams and canals. The upper shell looks as if it were of one piece of soft leather, and resembles a griddle-cake. Although soft-shelled, these turtles are far from soft-tempered, and must be handled with care.

LESSON LII

The Turtle

Leading thought—The turtle's shell is for the purpose of protecting its owner from the attack of enemies. Some turtles live upon land and others in water.

Method—A turtle of any kind, in the schoolroom, is all that is needed to make this lesson interesting.

A snapping turtle.
Photo by J. T. Lloyd.

Observations—1. How much can you see of the turtle when it is walking? If you disturb it what does it do? How much of it can you see then? Can you see more of it from the lower side than the upper? What is the advantage to the turtle of having such a shell?

2. Compare the upper shell with the lower as follows: How are they shaped differently? What is their difference in color? Would it be a disadvantage to the turtle if the upper shell were as light colored as the lower? Why? Make a drawing of the upper and the lower shell showing the shape of the plates of which they are composed. Where are the two grown together?

3. Is the border of the upper shell different from the central portion in color and markings? Is the edge smooth or scalloped?

4. How far does the turtle's head project from the front of the shell? What is the shape of the head? With what colors and pattern is it marked? Describe the eyes. How are they protected? How does the turtle wink? Can you discover the little eyelid which comes up from below to cover the eye?

5. Describe the nose and nostrils. Do you think it has a keen sense of smell?

6. Describe the mouth. Are there any teeth? With what does it bite off its food? Describe the movement of the throat. Why is this constant pulsation?

7. What is the shape of the leg? How is it marked? How many claws on the front feet? Are any of the toes webbed? On which feet are the webbed toes? Why should they be webbed? Describe the way a turtle swims. Which feet are used for oars?

8. Describe the tail. How much can be seen from above when the turtle is walking? What becomes of it, when the turtle withdraws into its shell?

9. How much of the turtle's body can you see? What is its color? Is it rough or smooth?

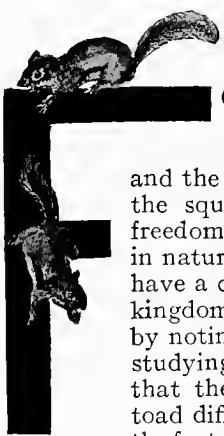
10. What are the turtle's enemies? How does it escape from them? What noise does the turtle make when frightened or angry?

11. Do all turtles live for part of the time in water? What is their food and where do they find it? Write an account of all the species of turtles that you know.

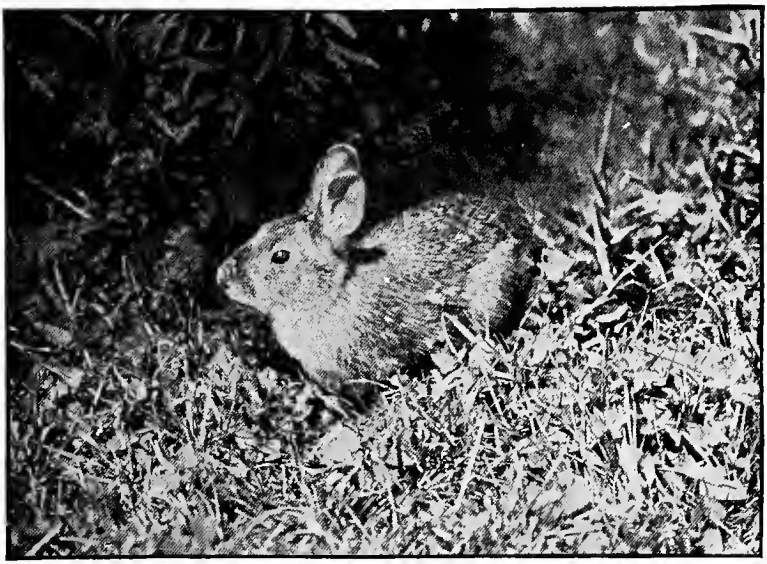
12. How do turtle eggs look? Where are they laid? How are they hidden?

Supplementary reading—"Turtle Eggs for Agassiz," Dalles Lore Sharp, Altantic Monthly, Feb., 1910.

V. MAMMAL STUDY



FOR some inexplicable reason, the word animal, in common parlance, is restricted to the mammals. As a matter of fact, the bird, the fish, the insect and the snake have as much right to be called animals as has the squirrel or the deer. And while I believe that much freedom in the matter of scientific nomenclature is permissible in nature-study, I also believe that it is well for the child to have a clearly defined idea of the classes into which the animal kingdom is divided; and I would have him gain this knowledge by noting how one animal differs from another rather than by studying the classification of animals in books. He sees that the fish differs in many ways from the bird and that the toad differs from the snake; and it will be easy for him to grasp the fact that the mammals differ from all other animals in that the young are nourished by milk produced for this purpose in the breasts of the mother; when he understands this, he can comprehend how such diverse forms as the whale, the cow, the bat, and human beings are akin.



A cotton-tail rabbit.

THE COTTON-TAIL RABBIT

Teacher's Story

"The Bunnies are a feeble folk whose weakness is their strength.
To shun a gun a Bun will run to almost any length."—OLIVER HERFORD.

IT IS well for Molly Cotton-tail and her family that they have learned to shun more than guns for almost every predatory animal and bird makes a dinner of them on every possible occasion. But despite these enemies, moreover, with the addition of guns, men and dogs, the cotton-tail lives and flourishes in our midst. A "Molly" raised two families last year in a briar-patch back of our garden on the Cornell Campus, where dogs of many breeds abound; and after each fresh fall of snow this winter we have been able to trace our bunny neighbors in their night wanderings around the house, beneath the spruces and in the orchard. The track consists of two long splashes, paired, and between and a little behind them, two smaller ones; the rabbit uses its front feet as a boy uses a vaulting pole and lands both hind feet on each side and ahead of them; owing to the fact that the bottoms of the feet are hairy the print is not clear-cut. When the rabbit is not in a hurry it has a peculiar lope, but when frightened it makes long jumps. The cotton-tails are night wanderers and usually remain hidden during the day. In summer, they feed on clover or grass or other juicy herbs and show a fondness for sweet apples and fresh cabbage; in our

garden last summer Molly was very considerate. She carefully pulled all the grass out of the garden-cress bed, leaving the salad for our enjoyment. In winter, the long, gnawing teeth of the cotton-tail are sometimes used to the damage of fruit trees and nursery stock since the rabbits are obliged to feed upon bark in order to keep alive.

The long, strong hind legs and the long ears tell the whole bunny story. Ears to hear the approach of the enemy, and legs to propel the listener by long jumps to a safe retreat. The attitude of the ears is a good indication of the bunny's state of mind; if they are set back to back and directed backward, they indicate placidity, but a placidity that is always on guard; if lifted straight up they signify attention and anxiety; if one is bent forward and the other backward the meaning is: "Now just where did that sound come from?" When running or when resting in the form, the ears are laid back along the neck. When the cotton-tail stands up on its haunches with both ears erect, it looks very tall indeed.

Not only are the ears always alert, but also the nose; the nostrils are partially covered and in order to be always sure of getting every scent they wabble constantly, the split upper lip aiding in this performance; when the rabbit is trying to get a scent it moves its head up and down in a sagacious, apprehensive manner.

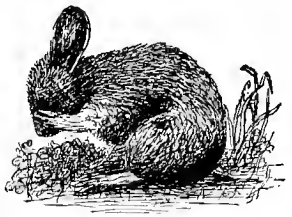
The rabbit has an upper and lower pair of incisors like other rodents, but on the upper jaw there is a short incisor on each side of the large teeth; these are of no use now but are inherited from some ancestor which found them useful. There are at the back of each side of the upper jaw six grinding teeth, and five on each side of the lower jaw. The split upper lip allows the free use of the upper incisors. The incisors are not only used for taking the bark from trees, but also for cutting grass and other food. The rabbit has a funny way of taking a stem of grass or clover at the end and with much wabbling of lips, finally taking it in, meanwhile chewing it with a sidewise motion of the jaws. The rabbits' whiskers are valuable as feelers, and are always kept on the *qui vive* for impressions; when two cotton-tails meet each other amicably, they rub whiskers together. The eyes are large and dark and placed on the bulge at the side of the head, so as to command the view both ways. Probably a cotton-tail winks, but I never caught one in the act.

The strong hind legs of the rabbit enable it to make prodigious jumps, of eight feet or more; this is a valuable asset to an animal that escapes its enemies by running. The front feet are short and cannot be turned inward like those of the squirrel, to hold food. There are five toes on the front feet, and four on the hind feet; the hair on the bottom of the feet is a protection, much needed by an animal which sits for long periods upon the snow. When sleeping, the front paws are folded under and the rabbit rests on the entire hind foot, with the knee bent, ready for a spring at the slightest alarm; when awake, it rests on the hind feet and front toes; and when it wishes to see if the coast is clear, it rises on its hind feet, with front paws drooping.

The cotton-tail has a color well calculated to protect it from observation; it is brownish-gray on the back and a little lighter along the sides, grayish under the chin and whitish below; the ears are edged with black, and the tail when raised shows a large, white fluff at the rear. The general color of the rabbit fits in with natural surroundings; since the cotton-tail often escapes its enemies by "freezing," this color makes the scheme work

well. I once saw a marsh hare, on a stone in a brook, freezing most successfully. I could hardly believe that a living thing could seem so much like a stone; only its bright eyes revealed it to us.

The rabbit cleans itself in amusing ways. It shakes its feet, one at a time, with great vigor and rapidity to get off the dirt and then licks them clean. It washes its face with both front paws at once. It scratches its ear with the hind foot, and pushes it forward so that it can be licked; it takes hold of its fur with its front feet to pull it around within reach of the tongue.

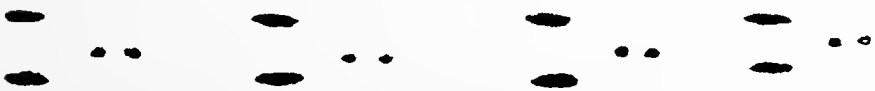


Washing up.

The cotton-tail does not dig a burrow, but sometimes occupies the deserted burrow of a woodchuck or skunk. Its nest is called a "form," which simply means a place beneath a cover of grass or briars, where the grass is beaten down or eaten out for a space large enough for the animal to sit. The mother makes a soft bed for the young, using grass and her own hair for the purpose; and she constructs a coarse felted coverlet, under which she tucks her babies with care, every time she leaves them. Young rabbits are blind at first, but when about three weeks old, are sufficiently grown to run quite rapidly. Although there may be five or six in a litter, yet there are so many enemies that only a few escape.

Fox, mink, weasel, hawk, owl and snake all relish the young cotton-tail if they can get it. Nothing but its runways through the briars can save it. These roads wind in and out and across, twisting and turning perplexingly; they are made by cutting off the grass stems, and are just wide enough for the rabbit's body. However, a rabbit has weapons and can fight if necessary; it leaps over its enemy, kicking it on the back fiercely with its great hind feet. Mr. Seton tells of this way of conquering the black snake, and Mr. Sharp saw a cat completely vanquished by the same method. The rabbit can also bite, and when two males are fighting, they bite each other savagely. Mr. E. W. Cleeves told me of a Belgian doe which showed her enmity to cats in a peculiar way. She would run after any cats that came in sight, butting them like a billy-goat. The cats soon learned her tricks, and would climb a tree as soon as they caught sight of her. The rabbit's sound of defiance, is thumping the ground with the strong hind foot. Some have declared that the front feet are used also for stamping; although I have heard this indignant thumping more than once, I could not see the process. The cotton-tail is a hare, while the common domestic rabbit is a true rabbit. The two differ chiefly in the habits of nesting; the hares rest and nest in forms, while the rabbit makes burrows, digging rapidly with the front feet.

Not the least of tributes to the rabbit's sagacity, are the negro folk-stories told by Uncle Remus, wherein Bre'r Rabbit, although often in trouble, is really the most clever of all the animals. I have often thought



Rabbit tracks.

when I have seen the tactics which rabbits have adopted to escape dogs, that we in the North have under-rated the cleverness of this timid animal. In one instance at least that came under our observation, a cotton-tail led a dog to the verge of a precipice, then doubled back to safety, while the dog went over, landing on the rocks nearly three hundred feet below.

LESSON LIII

The Cotton-tail Rabbit

Belgian hares and Dutch rabbit.

Leading thought—The cotton-tail thrives amid civilization; its color protects it from sight; its long ears give it warning of the approach of danger; and its long legs enable it to run by swift, long leaps. It feeds upon grasses, clover, vegetables and other herbs.

Method—This study may be begun in the winter, when the rabbit tracks can be observed and the haunts of the cotton-tail discovered. If caught in a box trap, the cotton-tail will become tame if properly fed and cared for, and may thus be studied at close range. The cage I have used for rabbits as thus caught, is made of wire screen, nailed to a frame, making a wire-covered box, two feet high and two or three feet square, with a door at one side and no bottom. It should be placed upon oil-cloth or linoleum, and thus may be moved to another carpet when the floor needs cleaning. If it is impossible to study the cotton-tail, the domestic rabbit may be used instead.

Observations—1. What sort of tracks does the cotton-tail make in the snow? Describe and sketch them. Where do you find these tracks? How do you know which way the rabbit was going? Follow the track and see if you can find where the rabbit went. When were these tracks made, by night or by day? What does the rabbit do during the day? What does it find to eat during the winter? How are its feet protected so that they do not freeze in the snow?

2. What are the two most noticeable peculiarities of the rabbit? Of what use are such large ears? How are the ears held when the rabbit is resting? When startled? When not quite certain about the direction of the noise? Explain the reasons for these attitudes. When the rabbit wishes to make an observation to see if there is danger coming, what does it do? How does it hold its ears then? How are the ears held when the animal is running?

3. Do you think the rabbit has a keen sense of smell? Describe the movements of the nostrils and explain the reason. How does it move its head to be sure of getting the scent?

4. What peculiarity is there in the upper lip? How would this be an aid to the rabbit when gnawing? Describe the teeth; how do these differ from those of the mouse or squirrel? Of what advantage are the gnawing teeth to the rabbit? How does it eat a stem of grass? Note the rabbit's whiskers. What do you think they are used for?

5. Describe the eyes. How are they placed so that the rabbit can see forward and backward? Do you think that it sleeps with its eyes open? Does it wink?

6. Why is it advantageous to the rabbit to have such long, strong, hind legs? Compare them in size with the front legs. Compare the front and hind feet. How many toes on each? How are the bottoms of the feet protected? Are the front feet ever used for holding food like the squirrel's? In what position are the legs when the rabbit is resting? When it is standing? When lifted up for observation?

7. How does the cotton-tail escape being seen? Describe its coat. Of what use is the white fluff beneath the tail? Have you ever seen a wild rabbit "freeze"? What is meant by freezing and what is the use of it?

8. In making its toilet how does the rabbit clean its face, ears, feet, and fur?

9. What do the cotton-tails feed upon during the summer? During the winter? Do they ever do much damage?

10. Describe the cotton-tail's nest. What is it called? Does it ever burrow in the ground? Does it ever use a second-hand burrow? Describe the nest made for the young by the mother. Of what is the bed composed? Of what is the coverlet made? What is the special use of the coverlet? How do the young cotton-tails look? How old are they before they are able to take care of themselves?

11. What are the cotton-tail's enemies? How does it escape them? Have you ever seen the rabbit roads in a briar patch? Do you think that a dog or fox could follow them? Do rabbits ever fight their enemies? If so, how? How do they show anger? Do they stamp with the front or the hind foot?

12. Tell how the cotton-tail differs in looks and habits from the common tame rabbit. How do the latter dig their burrows? How many breeds of tame rabbits do you know?

13. Write or tell stories on the following topics: "A Cotton-tail's Story of its Own Life Until it is a Year Old;" "The Jack-rabbit of the West;" "The Habits of the White Rabbit or Varying Hare;" "The Rabbit in Uncle Remus' Tales."

Supplementary reading—"Raggylug" and "Little War Horse," Thompson-Seton; Squirrels and Other Fur Bearers, Burroughs; Watchers in the Woods, Sharp; American Animals, Stone & Cram; Familiar Life in Field and Forest, Mathews; Sharp Eyes, Gibson; Neighbors with Claws and Hoofs, Johonnot; True Tales of Birds and Beasts, Jordan; Uncle Remus Stories, especially The Tar Baby, which emphasizes the fact that the rabbits' runways are in the protecting briar-patch.

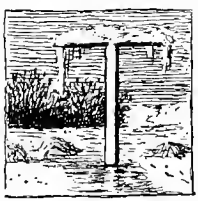
Winter lodge of muskrats.
Photo by Silas Lottridge.

THE MUSKRAT

Teacher's Story

"Having finished this first course of big-neck clams, they were joined by a third muskrat, and, together, they filed over the bank and down into the meadow. Shortly two of them returned with great mouthfuls of the mud-bleached ends of calamus-blades. Then followed the washing.

They dropped their loads upon the plank, took up the stalks, pulled the blades apart, and soused them up and down in the water, rubbing them with their paws until they were as clean and white as the whitest celery one ever ate. What a dainty picture! Two little brown creatures, humped on the edge of a plank, washing calamus in moonlit water!"—Dallas Lore Sharp.



TRACKING is a part of every boy's education who aspires to a knowledge of wood lore; and a boy with this accomplishment is sure to be looked upon with great admiration by other boys, less skilled in the interpretation of that writing made by small feet, on the soft snow or on the mud of stream margins. To such a boy, the track of the muskrat is well known, and very easily recognized.

The muskrat is essentially a water animal, and therefore its tracks are to be looked for along the edges of ponds, streams or in marshes. Whether the tracks are made by walking or jumping, depends upon the depth of the snow or mud; if it is deep, the animal jumps, but in shallow snow or mud, it simply runs along. The tracks show the front feet to be smaller

than the hind ones. The muskrat track is, however, characterized by the tail imprint. When the creature jumps through the snow, the mark of the tail follows the paired imprints of the feet; when it walks, there is a continuous line made by this strong, naked tail. This distinguishes the track of the muskrat from that of the mink, as the bushy tail of the latter does not make so distinct a mark. Measuring the track, is simply a device for making the pupils note its size and shape more carefully. The tracks may be looked for during the thaws of March or February, when the muskrats come out of the water to seek food.

In appearance the muskrat is peculiar. The body is usually about a foot in length and the tail about eight inches. The body is stout and thickset, the head is rounded and looks like that of a giant meadow mouse; the eyes are black and shining; the ears are short and close to the head; the teeth, like those of other rodents, consist of a pair of front teeth on each jaw, then a long, bare space and four grinders on each side. There are long sensitive hairs about the nose and mouth, like the whiskers of mice.

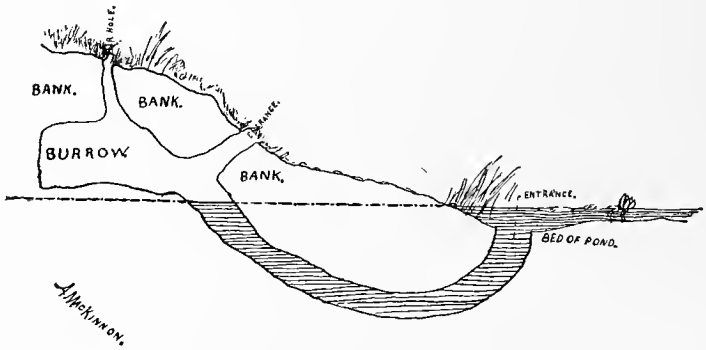
The muskrat's hind legs are much larger and stronger than the front ones; and too, the hind feet are much longer than the front feet and have a web between the toes; there are also stiff hairs which fill the space between the toes, outside the web, thus making this large hind foot an excellent swimming organ. The front toes are not webbed and are used for digging. The claws are long, stout and sharp. The tail is long, stout and flattened at the sides; it has little or no fur upon it but is covered with scales; it is used as a scull and also as a rudder when the muskrat is swimming.

The muskrat's outer coat consists of long, rather coarse hairs; its under coat is of fur, very thick and fine, and although short, it forms a waterproof protection for the body of the animal. In color, the fur is dark brown above with a darker streak along the middle of the back; beneath, the body is grayish changing to whitish on the throat and lips, with a brown spot on the chin. In preparing the pelts for commercial use, the long hairs are plucked out leaving the soft, fine under coat, which is dyed and sold under the name of "electric seal."

The muskrat is far better fitted by form, for life in the water than upon the land. Since it is heavy-bodied and short-legged, it cannot run rapidly but its strong, webbed hind feet are most efficient oars, and it swims rapidly and easily; for rudder and propeller the strong, flattened tail serves admirably, while the fine fur next the body is so perfectly waterproof that, however much the muskrat swims or dives, it is never wet. It is a skillful diver and can stay under water for several minutes; when swimming, its nose and sometimes the head and the tip of the tail appear on the surface of the water.

The food of muskrats is largely roots, especially those of the sweet flag and the yellow lily. They also feed on other aquatic plants and are fond of the fresh-water shell-fish. Mr. Sharp tells us, in one of his delightful stories, how the muskrats wash their food by sousing it up and down in water many times before eating it. Often, a muskrat chooses some special place upon the shore which it uses for a dining-room, bringing there and eating pieces of lily root or fresh-water clams, and leaving the debris to show where it habitually dines. It does most of its hunting for food at night, although sometimes it may be seen thus employed during the day.

The winter lodge of the muskrat is a most interesting structure. A foundation of tussocks of rushes, in a stream or shallow pond, is built upon with reeds plastered with mud, making a rather regular dome which may be nearly two or three feet high; or, if many-chambered, it may be a grand affair of four or five feet elevation; but it always looks so much like a natural hummock that the eye of the uninitiated never regards it as a habitation. Always beneath this dome and above the water line, is a snug, covered chamber carpeted with a soft bed of leaves and moss, which has a passage leading down into the water below, and also has an air-hole for ventilation. In these cabins, closely cuddled together, three or four in a chamber, the muskrats pass the winter. After the pond is frozen they are safe from their enemies and are always able to go down into the water and feed upon the roots of water plants. These cabins are sometimes built in the low, drooping branches of willows or on other objects.



A muskrat's summer home.
Drawn by A. MacKinnon, a boy of 13 years.

Whether the muskrat builds itself a winter lodge or not, depends upon the nature of the shore which it inhabits; if it is a place particularly fitted for burrows, then a burrow will be used as a winter retreat; but if the banks are shallow, the muskrats unite in building cabins. The main entrance to the muskrat burrow is always below the surface of the water, the burrow slanting upward and leading to a nest well lined, which is above the reach of high water; there is always an air hole above, for ventilating this nest, and there is also often a passage, with a hidden entrance, leading out to dry land.

The flesh of the muskrat is delicious, and therefore the animal has many enemies; foxes, weasels, dogs, minks and also hawks and owls prey upon it. It escapes the sight of its enemies as does the mouse, by having the color of its fur not noticeable; when discovered, it escapes its enemies by swimming, although when cornered, it is courageous and fights fiercely, using its strong incisors as weapons. In winter, it dwells in safety when the friendly ice protects it from all its enemies except the mink; but it is exposed to great danger when the streams break up in spring, for it is then often driven from its cabin by floods, and preyed upon while thus helplessly exposed. The muskrat gives warning of danger to its fellows by splashing the water with its strong tail.

The muskrat.
Photo by Silas Lottridge.

It is called muskrat because of the odor, somewhat resembling musk, which it exhales from two glands on the lower side of the body between the hind legs; these glands may be seen when the skin is removed, which is the too common plight of this poor creature, since it is hunted mercilessly for its pelt.

The little muskrats are born in April and there are usually from six to eight in a litter. Another litter may be produced in June or July and a third in August or September. It is only thus, by rearing large families often, that the muskrats are able to hold their own against the hunters and trappers and their natural enemies.

References—Wild Animals, Stone & Cram; A Watcher in the Woods, Sharp; Wild Life, Ingersoll; Farmers' Bulletin No. 396, U. S. Dept. of Agriculture.

LESSON LIV

The Muskrat

Leading thought—The muskrat, while a true rodent, is fitted for life in the water more than for life upon the land. Its hind feet are webbed for use as oars and its tail is used as a rudder. It builds lodges of mud, cat-tails and rushes in which it spends the winter.

Method—It might be well to begin this work by asking for observations on the tracks of the muskrat which may be found about the edges of almost any creek, pond or marsh. If there are muskrat lodges in the region they should be visited and described. For studying the muskrat's form a live muskrat in captivity is almost necessary. If one is trapped

with a "figure four" it will not be injured and it may be made more or less tame by feeding it with sweet apples, carrots and parsnips. The pupils can thus study it at leisure although they should not be allowed to handle the creature as it inflicts very severe wounds and is never willing to be handled. If a live muskrat cannot be obtained perhaps some hunter in the neighborhood will supply a dead one for this observation lesson.

While studying the muskrat the children should read all the stories of beavers which are available as the two animals are very much alike in their habits.

Observations—1. In what locality have you discovered the tracks of the muskrat? Describe its general appearance. Measure the muskrat's track as follows: (a) Width and length of the print of one foot; (b) the width between the prints of the two hind feet; (c) the length between the prints made by the hind feet in several successive steps or jumps.

2. Was the muskrat's track made when the animal was jumping or walking? Can you see in it a difference in the size of the front and hind feet? Judging from the track, where do you think the muskrat came from? What do you think it was hunting for?

3. What mark does the tail make in the snow or mud? Judging by its imprint, should you think the muskrat's tail was long or short, bare or brushy, slender or strong?

4. How long is the largest muskrat you ever saw? How much of the whole length is tail? Is the general shape of the body short and heavy or long and slender?

5. Describe the muskrat's eyes, ears and teeth. For what are the teeth especially fitted? Has the muskrat whiskers like mice and rats?

6. Compare the front and hind legs as to size and shape. Is there a web between the toes of the hind feet? What does this indicate? Do you think that the muskrat is a good swimmer?

7. Describe the muskrat fur. Compare the outer and under coat. What is its color above and below? What is the name of muskrat fur in the shops?

8. Describe the tail. What is its covering? How is it flattened? What do you think this strong, flattened tail is used for?

9. Do you think the muskrat is better fitted to live in the water than on land? How is it fitted to live in the water in the following particulars: Feet? Tail? Fur?

10. How much of the muskrat can you see when it is swimming? How long can it stay under water when diving?

11. What is the food of the muskrat? Where does it find it? How does it prepare the food for eating? Does it seek its food during the night or day? Have you ever observed the muskrat's dining room? If so, describe it.

12. Describe the structure of the muskrat's winter lodge, or cabin, in the following particulars: Its size. Where built? Of what material? How many rooms in it? Are these rooms above or below the water level? Of what is the bed made? How is the nest ventilated? How is it arranged so that the entrance is not closed by the ice? Is such a home built by one or more muskrats? How many live within it? Do the muskrats always build these winter cabins? What is the character of the shores where they are built?

13. Describe the muskrat's burrow in the bank in the following particulars: Is the entrance above or below water? Where and how is the nest made? Is it ventilated? Does it have a back door leading out upon the land?

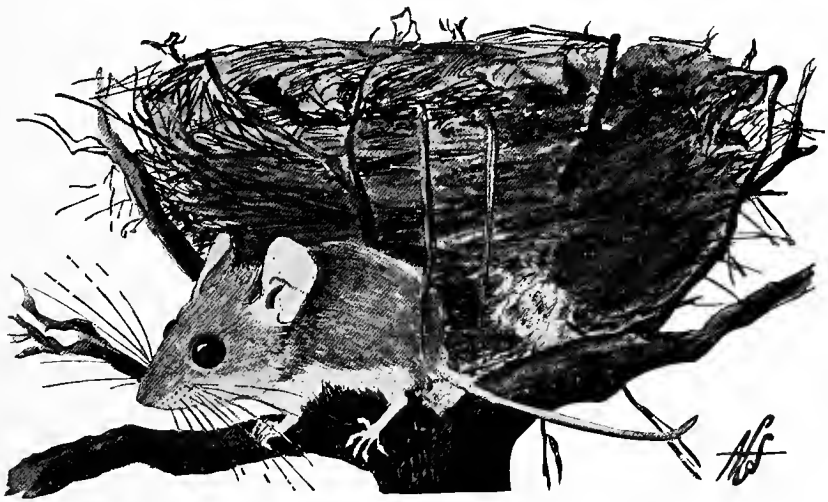
14. What are the muskrat's enemies? How does it escape them? How does it fight? Is it a courageous animal? How does the muskrat give warning to its fellows when it perceives danger? At what time of year is it comparatively safe? At what time is it exposed to greatest danger?

15. Why is this animal called muskrat? Compare the habits of muskrats with those of beaver and write an English theme upon the similarity of the two.

16. At what time of year do you find the young muskrats? How many in a litter?

17. Read Farmers' Bulletin No. 396 of the U. S. Dept. of Agriculture and write an English theme on the destructive habits of muskrats and the economic uses of these animals.

Supplementary reading—Familiar Wild Animals, Lottridge; Little Beasts of Field and Wood, Cram; Squirrels and other Fur-bearers, Burroughs; "The Builders" in Ways of Wood Folk, Long.



The white-footed, or deer, mouse.
Drawn by Anna Stryke.

The house mouse feeds upon almost anything which people like to eat.

THE HOUSE MOUSE

Teacher's Story

Somewhere in the darkness a clock strikes two;
And there is no sound in the sad old house,
But the long veranda dripping with dew,
And in the wainscot—a mouse.—BRET HARTE.

WERE mouse-gray a less inconspicuous color, there would be fewer mice; when a mouse is running along the floor, it is hardly discernible, it looks so like a flitting shadow; if it were black or white or any other color, it would be more often seen and destroyed. Undoubtedly, it is owing to the fact that its soft fur has this shadowy color, that this species has been able to spread over the world.

At first glance one wonders what possible use a mouse can make of a tail which is as long as its body, but a little careful observation will reveal the secret. The tail is covered with transverse ridges and is bare save for sparse hairs, except toward the tip. Dr. Ida Reveley first called my attention to the fact that the house mouse uses its tail in climbing. I verified this interesting observation, and found that my mouse used the tail for aid when climbing a string. He would go up the string, hand over hand, like a sailor, then in trying to stretch to the edge of his jar, he invariably wound his tail about the string two or three times, and hanging to the string with the hind feet and tail, would reach far out with his head and front feet. Also, when clinging to the edge of the cover of the jar, he invariably used his tail as a brace against the side of the glass, so that it pressed hard for more than half its length. Undoubtedly the tail is of great service when climbing up the sides of walls.

The tail is also of some use, when the mouse jumps directly upwards. The hind legs are very much longer and stronger than the front legs. The hind feet are also much longer and larger than the front feet; and although the mouse, when it makes its remarkable jumps, depends upon its strong hind legs, I am sure that often the tail is used as a brace to guide and assist the leap. The feet are free from hairs but are downy; the hind foot has three front toes, a long toe behind on the outside and a short one on the inside. The claws are fairly long and very sharp so that they are able to cling to almost anything but glass. When exploring, a mouse stands on its hind feet, folding its little front paws under its chin while it reaches up ready to catch anything in sight; it can stretch up to an amazing height. It feeds upon almost anything which people like to eat and, when eating, holds its food in its front paws like a squirrel.

The thin, velvety ears are flaring cornucopias for taking in sound; the large, rounded outer ear can be moved forward or back to test the direction of the noise. The eyes are like shining, black beads; and if a mouse can wink, it does it so rapidly as not to be discernible. The nose is long, inquisitive, and always sniffing for new impressions. The whiskers are delicate and probably sensitive. The mouth is furnished with two long, curved gnawing teeth at the front of each jaw, then a bare space, and four grinding teeth on each side, above and below, like the teeth of woodchucks and other rodents. The gnawing teeth are very strong and enable the mouse to gnaw through board partitions and other obstacles.

The energy with which the mouse cleans itself is inspiring to behold. It nibbles its fur and licks it with fervor, reaching around so as to get at it from behind, and taking hold with its little hands to hold firm while it cleans. When washing its face and head, it uses both front feet, licking them clean and rubbing them both simultaneously from behind the ears down over the face. It takes its hind foot in both front feet and nibbles and licks it. It scratches the back of its head with its hind foot.

Young mice are small, downy, pink and blind when born. The mother makes for them a nice, soft nest of pieces of cloth, paper, grass, or whatever is at hand; the nest is round like

Young mice, blind, pink and hairless.

a ball and at its center is nestled the family. Mice living in houses, have runways between the plaster and the outside, or between ceiling and floor. In winter they live on what food they can find, and upon flies or other insects hibernating in our houses. The house mice sometimes live under stacks of corn or grain in the fields, but usually confine themselves to houses or barns. They are thirsty little fellows and they like to make their nests within easy reach of water. Our house mice came from ancestors which lived in Asia originally; they have always been great travelers and they have followed men wherever they have gone, over the world. They came to America on ships with the first explorers and the Pilgrim fathers. They now travel back and forth, crossing the ocean in ships of all sorts. They also travel across the continent on trains. Wherever our food is carried they go; and the mouse, which you see in your room one day, may be a thousand miles away within a week. They are clever creatures, and learn quickly to connect cause and effect. For two years, I was in an office in Washington, and as soon as the bell rang for noon, the mice would appear instantly, hunting waste-baskets for scraps of lunch. They had learned to connect the sound of the bell with food.

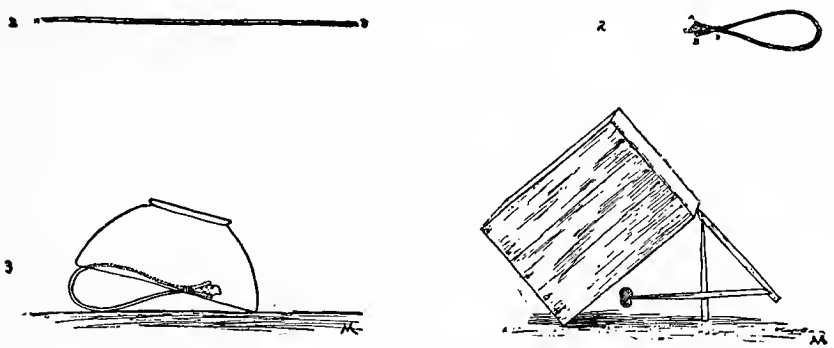
Of all our wild mice, the white-footed or deer mouse is the most interesting and attractive. It is found almost exclusively in woods and is quite different in appearance from other mice. Its ears are very large; its fur is fine and beautiful and a most delicate gray color. It is white beneath the head and under the sides of the body. The feet are pinkish, the front paws have short thumbs, while the hind feet are very much longer and have a long thumb looking very much like an elfin hand in a gray-white silk glove. On the bottom of the feet are callous spots which are pink and serve as foot pads. It makes its nest in hollow trees and stores nuts for winter use. We once found two quarts of shelled beech nuts in such a nest. It also likes the hips of the wild rose and many kinds of berries; it sometimes makes its summer home in a bird's nest, which it roofs over to suit itself. The young mice are carried, hanging to the mother's breasts. As an inhabitant of summer cottages, white-foot is cunning and mischievous; it pulls cotton out of quilts takes covers off of jars, and as an explorer, is equal to the squirrel. I once tried to rear some young deer mice by feeding them warm milk with a pipette; although their eyes were not open, they invariably washed their faces after each meal, showing that neatness was bred in the bone. This mouse has a musical voice and often chirps as sweetly as a bird. Like the house mouse it is more active at night.

Track of white-footed mouse.
Notice tail-track.

The meadow mouse is the one that makes its run-ways under the snow, making strange corrugated patterns over the ground which attract our attention in spring. It has a heavy body, short legs, short ears and short tail. It is brownish or blackish in color. It sometimes digs burrows straight into the ground, but more often makes its nest beneath sticks and

stones or stacks of corn. It is the nest of this field mouse which the bumblebee so often takes possession of, after it is deserted. The meadow mouse is a good fighter, sitting up like a woodchuck and facing its enemy bravely. It needs to be courageous, for it is preyed upon by almost every creature that feeds upon small animals; the hawks and owls especially are its enemies. It is well for the farmer that these mice have so many enemies, for they multiply rapidly and would otherwise soon overrun and destroy the grain fields. This mouse is an excellent swimmer.

A part of winter work, is to make the pupils familiar with the tracks of the meadow mice and how to distinguish them from other tracks.



Mouse traps.

The bow trap. 1. A smooth splint or a peeled twig.
2. Splint bowed and tied at D, the bait inserted at C.
3. The inverted bowl balanced on splint bow.

Figure 4, trap.

Trapping Field Mice—Probably wild animals have endured more cruelty through the agency of traps than through any other form of human persecution. The savage steel traps often catch the animal by the leg, holding it until it gnaws off the imprisoned foot, and thus escapes maimed and handicapped for its future struggle for food; or if the trap gets a strong hold, the poor creature may suffer tortures during a long period, before the owner of the trap appears to put an end to its sufferings by death. If box traps are used, they are often neglected and the poor creature imprisoned, is left to languish and starve. The teacher cannot enforce too strongly upon the child the ethics of trapping. Impress upon him that the box traps are far less cruel; but that if set, they must be examined regularly and not neglected. The study of mice affords a good opportunity for giving the children a lesson in humane trapping. Let them set a figure 4 or a bowl trap, which they must examine every morning. The little prisoners may be brought to school and studied; meanwhile, they should be treated kindly and fed bountifully. After a mouse has been studied, it should be set free, even though it be one of the quite pestiferous field mice. The moral effect of killing an animal, after a child has become thoroughly interested in it and its life, is always bad.

References—Claws and Hoofs, Johomot, American Animals, Stone & Cram; Secrets of the Woods, Long; Wild Life, Ingersoll; Familiar Wild Animals, Lottridge.

LESSON LV

The House Mouse

Leading thought—The mouse is fitted by color, form, agility and habits to thrive upon the food which it steals from man, and to live in the midst of civilized people.

Method—A mouse cage can be easily made of wire window-screen tacked upon a wooden frame. I have even used aquarium jars with wire screen covers, and by placing one jar upon another, opening to opening, and then laying them horizontal, the mouse can be transferred to a fresh cage without trouble, and thus the mousey odor can be obviated, while the little creature is being studied. A little water in a wide-necked bottle can be lowered into this glass house by a string, and the food can be given in like manner. Stripped paper should be put into the jar for the comfort of the prisoner; a stiff string hanging down from the middle of the cage will afford the prisoner a chance to show his feats as an acrobat.

Observations—1. Why is the color of the mouse of special benefit to it? Do you think it protects it from the sight of its enemies? Can you see a mouse easily as it runs across the room? What is the nature of the fur of a mouse?

2. How long is a mouse's tail as compared with its body? What is the covering of the tail? Of what use to the mouse is this long, ridged tail? Watch the mouse carefully and discover, if you can, the use of the tail in climbing.

3. Is the mouse a good jumper? Are the hind legs long and strong when compared with the front legs? How high do you think a mouse can jump? Do you think it uses its tail as an aid in jumping? How much of the legs are covered with hair? Compare the front and hind feet. What sort of claws have they? How does the mouse use its feet when climbing the string? How can it climb up the side of a wall?

4. Describe the eyes. Do you think the mouse can see very well? Does it wink? What is the shape of the ears? Do you think it can hear well? Can it move its ears forward or backward?

5. What is the shape of the snout? Of what advantage is this? Note the whiskers. What is their use? Describe the mouth. Do you know how the teeth are arranged? For what other use than to bite food does the mouse use its teeth? What other animals have their teeth arranged like those of the mouse? What food does the house mouse live upon? How does it get it?

6. How does the mouse act when it is reaching up to examine something? How does it hold its front feet? Describe how the mouse washes its face. Its back. Its feet.

7. Where does the house mouse build its nest? Of what material? How do the baby mice look? Can they see when they are first born?

8. House mice are great travelers. Can you tell how they manage to get from place to place? Write a story telling all you know of their habits.

9. How many kinds of mice do you know? Does the house mouse ever live in the field? What do you know of the habits of the white-footed mouse? Of the meadow mice? Of the jumping mice?

THE WOODCHUCK

Teacher's Story

HE who knows the ways of the woodchuck can readily guess where it is likely to be found; it loves meadows and pastures where grass or clover lushly grows. It is also fond of garden truck and has a special delectation for melons. The burrow is likely to be situated near a fence or stone heap, which gives easy access to the chosen food. The woodchuck makes its burrow by digging the earth loose with its front feet, and pushing it backward and out of the entrance with the hind feet. This method leaves the soil in a heap near the entrance, from which paths radiate into the grass in all directions. If one undertakes to dig out a woodchuck, one needs to be not only a husky individual, but something of an engineer; the direction of the burrow extends downward for a little way, and then rises at an easy angle, so that the inmate may be in no danger of flood. The nest is merely an enlargement of the burrow, lined with soft grass, which the woodchucks bring in in their mouths. During the early part of the season, the father and mother and the litter of young may inhabit the same burrow, although there are likely to be at least two separate nests. There is usually more than one back door to the woodchuck's dwelling, through which it may escape, if pressed too closely by enemies; these back doors differ from the entrance, in that they are usually hidden and have no earth heaped near them.

The woodchuck usually feeds in the morning and again in the evening, and is likely to spend the middle of the day resting. It often goes some distance from its burrow to feed, and at short intervals, lifts itself upon its hind feet to see if the coast is clear; if assailed, it will seek to escape by running to its burrow; and when running, it has a peculiar gait well described as "pouring itself along." If it reaches its burrow, it at once begins to dig deeply and throw the earth out behind it, thus making a wall to keep out the enemy. When cornered, the woodchuck is a courageous and fierce fighter; its sharp incisors prove a powerful weapon and it will often whip a dog much larger than itself. Every boy knows how to find whether the woodchuck is in its den or not, by rolling a stone into the burrow, and listening; if the animal is at home, the sound of its digging apprises the listener of the fact. In earlier times, the ground-hogs were much preyed upon by wolves, wildcats and foxes; now, only the fox remains and he is fast disappearing, so that at present, the farmer and his dog are about the only enemies this burrower has to contend with. It is an animal of resources and will climb a tree if attacked by a dog; it will also climb trees for fruit, like peaches. During the late summer, it is the ground-hog's business to feed very constantly and become very fat. About the first of October, it retires to its den and sleeps until the end of March or April. During this dormant state, the beating of its heart is so faint as to be scarcely perceptible, and very little nourishment is required to keep it alive; this nourishment is supplied by the fat stored in its body, which it uses up by March, and comes out of its burrow in the spring, looking gaunt and lean. The old saying that the ground-hog comes out on

Candlemas Day, and if it sees its shadow, goes back to sleep for six weeks more, may savor of meteorological truth, but it is certainly not true of the ground-hog.

The full-grown woodchuck ordinarily measures about two feet in length. Its color is grizzly or brownish, sometimes blackish in places; the under parts are reddish and the feet black. The fur is rather coarse, thick and brown, with longer hairs which are grayish. The skin is very thick and tough and seems to fit loosely, a condition which gives the peculiar "pouring along" appearance when it is running. The hind legs and feet are longer than those in front. Both pairs of feet are fitted for digging, the front ones being used for loosening the earth and the hind pair for kicking it out of the burrow.

The woodchuck's ears are roundish and not prominent, and by muscular contraction they are closed when the animal is digging, so that no soil can enter; the sense of hearing is acute. The teeth consist of two large incisors at the front of each jaw, a bare space and four grinders on each side, above and below; the incisors are used for biting food and also for fighting. The eyes are full and bright. The tail is short and brushy, and it with the hind legs, form a tripod which supports the animal, as it sits with its forefeet lifted.

Treed!
Photo by Verne Morton.

When feeding, the woodchuck often makes a contented grunting noise; when attacked and fighting, it growls; and when feeling happy and conversational, it sits up and whistles. I had a woodchuck acquaintance once which always gave a high, shrill, almost birdlike whistle when I came in view, a very jolly greeting. There are plenty of statements in books that woodchucks are fond of music, and Mr. Ingersoll states that at Wellesley College a woodchuck on the chapel lawn was wont to join the morning song exercises with a "clear soprano." The young woodchucks are born about the first of May and the litter usually numbers four or five. In June the "chucklings" may be seen following the mother in the field with much babyish grunting. If

captured at this period, they make every interesting pets. By August or September the young woodchucks leave the home burrow and start burrows of their own.

References—Wild Animals, Stone & Cram; Wild Neighbors, Ingersoll; Squirrels and Other Fur Bearers, Burroughs; Familiar Wild Animals, Lottridge.

LESSON LVI

The Woodchuck or Ground-Hog

Leading thought—The woodchuck has thriven with civilization, notwithstanding the farmer's dog, gun, traps and poison. It makes its nest in a burrow in the earth and lives upon vegetation; it hibernates in winter.

Method—Within convenient distance for observation by the pupils of every country schoolhouse and of most village schoolhouses, may be found a woodchuck and its dwelling. The pupils should be given the outline for observations which should be made individually through watching the woodchuck for weeks or months.

Observations—1. Where is the woodchuck found? On what does it live? At what time of day does it feed? How does it act when startled?

2. Is the woodchuck a good fighter? With what weapons does it fight? What are its enemies? How does it escape its enemies when in or out of its burrow? How does it look when running?

3. What noises does the woodchuck make and what do they mean? Play a "mouth-organ" near the woodchuck's burrow and note if it likes music.

4. How does the woodchuck make its burrow? Where is it likely to be situated? Where is the earth placed which is taken from the burrow? How does the woodchuck bring it out? How is the burrow made so that the woodchuck is not drowned in case of heavy rains? In what direction do the underground galleries go? Where is the nest placed in relation to the galleries? Of what is the nest made? How is the bedding carried in? Of what special use is the nest?

5. Do you find paths leading to the entrances of the burrow? If so, describe them. How can you tell whether a woodchuck is at home or not if you do not see it enter? Where is the woodchuck likely to station itself when it sits up to look for intruders?

6. How many woodchucks inhabit the same burrow? Are there likely to be one or more back doors to the burrow? What for? How do the back doors differ from the front doors?

7. How long is the longest woodchuck that you have ever seen? What is the woodchuck's color? Is its fur long or short? Coarse or fine? Thick or sparse? Is the skin thick or thin? Does it seem loose or close fitting?

8. Compare the front and hind feet and describe difference in size and shape. Are either or both slightly webbed? Explain how both front and hind feet and legs are adapted by their shape to help the woodchuck. Is the tail long or short? How does it assist the animal in sitting up?

9. What is the shape of the woodchuck's ear? Can it hear well? Why are the ears not filled with soil when the animal is burrowing? Of what use are the long incisors? Describe the eyes.

10. How does the woodchuck prepare for winter? Where and how does it pass the winter? Did you ever know a woodchuck to come out on Candlemas Day to look for its shadow?

11. When does the woodchuck appear in the spring? Compare its general appearance in the fall and in the spring and explain the reason for the difference.

12. When are the young woodchucks born? What do you know of the way the mother woodchuck cares for her young?

As I turned round the corner of Hubbard's Grove, saw a woodchuck, the first of the season, in the middle of the field six or seven rods from the fence which bounds the wood, and twenty rods distant. I ran along the fence and cut him off, or rather overtook him, though he started at the same time. When I was only a rod and a half off, he stopped, and I did the same; then he ran again, and I ran up within three feet of him, when he stopped again, the fence being between us. I squatted down and surveyed him at my leisure. His eyes were dull black and rather inobvious, with a faint chestnut iris, with but little expression and that more of resignation than of anger. The general aspect was a coarse grayish brown, a sort of grisel. A lighter brown next the skin, then black or very dark brown and tipped with whitish rather loosely. The head between a squirrel and a bear, flat on the top and dark brown, and darker still or black on the tip of the nose. The whiskers black, two inches long. The ears very small and roundish, set far back and nearly buried in the fur. Black feet, with long and slender claws for digging. It appeared to tremble, or perchance shivered with cold. When I moved, it gritted its teeth quite loud, sometimes striking the under jaw against the other chatteringly, sometimes grinding one jaw on the other, yet as if more from instinct than anger. Whichever way I turned, that way it headed. I took a twig a foot long and touched its snout, at which it started forward and bit the stick, lessening the distance between us to two feet, and still it held alt the ground it gained. I played with it tenderly awhile with the stick, trying to open its gritting jaws. Ever its long incisors, two above and two below, were presented. But I thought it would go to sleep if I stayed long enough. It did not sit upright as sometimes, but standing on its fore feet with its head down, i. e., half sitting, half standing. We sat looking at one another about half an hour, till we began to feel mesmeric influences. When I was tired, I moved away, wishing to see him run, but I could not start him. He would not stir as long as I was looking at him or could see him. I walked around him; he turned as fast and fronted me still. I sat down by his side within a foot. I talked to him quasi forest lingo, baby-talk, at any rate in a concilatory tone, and thought that I had some influence on him. He gritted his teeth less. I chewed checkerberry leaves and presented them to his nose at last without a grit; though I saw that by so much gritting of the teeth he had worn them rapidly and they were covered with a fine white powder, which, if you measured it thus, would have made his anger terrible. He did not mind any noise I might make. With a little stick I lifted one of his paws to examine it, and held it up at pleasure. I turned him over to see what color he was beneath (darker or most pusely brown), though he turned himself back again sooner than I could have wished. His tail was also brown, though not very dark, rat-tail like, with loose hairs standing out on all sides like a caterpillar brush. He had a rather mild look. I spoke kindly to him. I reached checkerberry leaves to his mouth. I stretched my hands over him, though he turned up his head and still gritted a little. I laid my hand on him, but immediately took it off again, instinct not being wholly overcome. If I had had a few fresh bean leaves, thus in advance of the season, I am sure I should have tamed him completely. It was a frizzly tail. His is a humble, terrestrial color like the partridge's, well concealed where dead wiry grass rises above darker brown or chestnut dead leaves—a modest color. If I had had some food, I should have ended with stroking him at my leisure. Could easily have wrapped him in my handkerchief. He was not fat nor particularly lean. I finally had to leave him without seeing him move from the place. A large, clumsy, burrowing squirrel. Arctomys, bear-mouse. I respect him as one of the natives. He lies there, by his color and habits so naturalized amid the dry leaves, the withered grass, and the bushes. A sound nap, too, he has enjoyed in his native fields, the past winter. I think I might learn some wisdom of him. His ancestors have lived here longer than mine. He is more thoroughly acclimated and naturalized than I. Bean leaves the red man raised for him, but he can do without them.—THOREAU'S JOURNAL.

THE RED SQUIRREL OR CHICKAREE

Teacher's Story

Just a tawny glimmer, a dash of red and gray,
Was it a flitting shadow, or a sunbeam gone astray!
It glances up a tree trunk, and a pair of bright eyes glow
Where a little spy in ambush is measuring his foe.
I hear a mocking chuckle, then wrathful, he grows bold
And stays his pressing business to scold and scold and scold.

WE ought to yield admiring tribute to those animals which have been able to flourish in our midst despite man and his gun, this weapon being the most cowardly and unfair invention of the human mind. The only time that man has been a fair fighter, in combating his four-footed brethren, was when he fought them with a weapon which he wielded in his hand. There is nothing in animal comprehension which can take into account a projectile, and much less a shot from a gun; but though it does not understand, it experiences a deathly fear at the noise. It is pathetic to note the hush in a forest that follows the sound of a gun; every song, every voice, every movement is stilled and every little heart filled with nameless terror. How any man or boy can feel manly when, with this scientific instrument of death in his hands, he takes the life of a little squirrel, bird or rabbit, is beyond my comprehension. In pioneer days when it was a fight for existence, man against the wilderness, the matter was quite different; but now it seems to me that anyone who hunts what few wild creatures we have left, and which are in nowise injurious, is, whatever he may think of himself, no believer in fair play.

Within my own memory, the beautiful black squirrel was as common in our woods as was his red cousin; the shot-gun has exterminated this splendid species. Well may we rejoice that the red squirrel has, through its lesser size and greater cunning, escaped a like fate; and that pugnacious and companionable and shy, it lives in our midst and climbs our very roofs to sit there and scold us for coming within its range of vision.

It has succeeded not only in living despite of man, but because of man, for it rifles our grain bins and corn cribs and waxes opulent by levying tribute upon our stores.

Thoreau describes most graphically the movements of this squirrel. He says: "All day long the red squirrels came and went. One would approach at first warily, warily, through the shrub-oaks, running over the snow crust by fits and starts and like a leaf blown by the wind, now a few paces this way, with wonderful speed and waste of energy, making inconceivable haste with his "trotters," as if it were for a wager, and now as many paces that way, but never getting on more than half a rod at a time; and then suddenly pausing with a ludicrous expression and a gratuitous somersault, as if all the eyes of the universe were fixed on him, * * * and then suddenly, before you could say Jack Robinson he would be in the top of a young pitch pine, winding up his clock, and chiding all imaginary spectators, soliloquizing and talking to all the universe at the same time."

It is surely one of the most comical of sights to see a squirrel stop running and take observations; he lifts himself on his haunches, and with body bent forward, presses his little paws against his breast as if to say, "Be still, oh my beating heart!" which is all pure affectation because he knows he can scurry away in perfect safety. He is likely to take refuge on the far side of a tree, peeping out from this side and that, and whisking back like a flash as he catches our eye; we might never know he was there except as Riley puts it, "he lets his own tail tell on him." When climbing up or down a tree, he goes head first and spreads his legs apart to clasp as much of the trunk as possible; meanwhile his sharp little claws cling securely to the bark. He can climb out on the smallest twigs quite as well, when he needs to do so, in passing from tree to tree or when gathering acorns.

Red squirrel or Chickaree.

A squirrel always establishes certain roads to and from his abiding place and almost invariably follows them. Such a path may be entirely in the tree-tops, with air bridges from a certain branch of one tree to a certain branch of another, or it may be partially on the ground between trees. I have made notes of these paths in the vicinity of

my own home, and have noted that if a squirrel leaves them for exploring, he goes warily; while, when following them, he is quite reckless in his haste. When making a jump from tree to tree, he flattens himself as widely as possible and his tail is held somewhat curved, but on a level with the body, as if its wide brush helped to buoy him up and perhaps to steer him also.

During the winter the chickaree is quite dingy in color and is an inconspicuous object, especially when he "humps himself up" so that he resembles a knot on a limb; but with the coming of spring, he dons a brighter coat of tawny-red and along his sides, where the red meets the grayish white of the under side, there is a dark line which is very ornamental; and now his tail is a shower of ruddiness. As the season advances, the colors seem to fade; they are probably a part of his wooing costume. When dashing up a tree trunk, his color is never very striking but looks like the glimmer of sunlight; this has probably saved many of his kind from the gunner, whose eyes being at the front of his head, cannot compare in efficiency with those of the squirrel, which being large and full and alert, are placed at the sides of the head so as to see equally well in all directions.

The squirrel's legs are short because he is essentially a climber rather than a runner; the hips are very strong which insures his power as a jumper and his leaps are truly remarkable. A squirrel uses his front paws for hands in a most human way; with them he washes his face and holds his food up to his mouth while eating, and it is interesting to note the skill of his claws when used as fingers. The track he makes in the snow is quite characteristic. The tracks are paired and those of the large five-toed hind feet are always in front.

Squirrel tracks.

The squirrel has two pairs of gnawing teeth which are very long and strong, as in all rodents, and he needs to keep busy gnawing hard things with them, or they will grow so long that he cannot use them at all and will starve to death. He is very clever about opening nuts so as to get all the meats. He often opens a hickory nut with two holes which tap the places of the nut meats squarely; with walnuts or butternuts, which have much harder shells, he makes four small holes, one opposite each quarter of the kernel. He has no cheek-pouches like a chipmunk but he can carry corn and other grain. He often fills his mouth so full that his cheeks bulge out like those of a boy eating pop-corn; but anything as large as a nut he carries in his teeth. His food is far more varied than many suppose and he will eat almost anything eatable; he is a little pirate and enjoys stealing from others with keenest zest. In spring, he eats leaf buds and hunts our orchards for apple seeds. In winter, he feeds on nuts and cones; it is marvelous how he will take a cone apart, tearing off the scales and leaving them in a heap while searching for seeds; he is especially fond of the seeds of Norway spruce and hemlock. Of course, he is fond of nuts of all kinds and will cut the chestnut burs from the tree before they are ripe, so that he may get ahead of the other harvesters. He stores his food for winter in all sorts of odd places and often forgets

where he puts it. We often find his winter stores untouched the next summer. He also likes birds' eggs and nestlings, and if it were not for the chastisement he gets from the parent robins, he would work much damage in this way.

The squirrel is likely to be a luxurious fellow and have a winter and a summer home. The former is in some hollow tree or other protected place; the summer home consists of a platform of twigs in some tree-top, often built upon an abandoned crow or hawk nest; but just how he uses these two homes, is as yet, a matter of guessing and is a good subject for young naturalists to investigate. During the winter, he does not remain at home except in coldest weather, when he lies cozily with his tail wrapped around him like a boa to keep him warm. He is too full of interest in the world to lie quietly long, but comes out, hunts up some of his stores, and finds life worth while despite the cold. One squirrel adopted a bird house in one of our trees, and he or his kin have lived there for years; in winter, he takes his share of the suet put on the trees for birds, and because of his greediness, we have been compelled to use picture wire for tying on the suet.

The young are born in a protected nest, usually in the hollow of a tree. There are four to six young in a litter and they appear in April. If necessary to move the young, the mother carries the squirrel baby clinging to her breast with its arms around her neck.

The squirrel has several ways of expressing his emotions; one is by various curves in his long beautiful, bushy tail. If the creatures of the wood had a stage, the squirrel would have to be their chief actor. Surprise, incredulousness, indignation, fear, anger and joy are all perfectly expressed by tail gestures and also by voice. As a vocalist he excels; he chatters with curiosity, "chips" with surprise, scolds by giving a gutteral trill, finishing with a falsetto squeal. He is the only singer I know who can carry two parts at a time. Notice him sometimes in the top of a hickory or chestnut tree when nuts are ripe, and you will hear him singing a duet all by himself, a high shrill chatter with a chuckling accompaniment. Long may he abide with us as an uninvited guest at our cribs! For, though he be a freebooter and conscienceless, yet our world would lack its highest example of incarnate grace and activity, if he were not in it.

LESSON LVII

The Red Squirrel or Chickaree

Leading thought—The red squirrel by its agility and cleverness has lived on, despite its worst enemy—man. By form and color and activity it is fitted to elude the hunter.

Method—If a pet squirrel in a cage can be procured for observation at the school, the observations on the form and habits of the animal can be best studied thus; but a squirrel in a cage is an anomaly and it is far better to stimulate the pupils to observe the squirrels out of doors. Give the following questions, a few at a time, and ask the pupils to report the answers to the entire class. Much should be done with the supplementary reading, as there are many interesting squirrel stories illustrating its habits.

Observations—1. Where have you seen a squirrel? Does the squirrel trot along or leap when running on the ground? Does it run straight ahead or stop at intervals for observation? How does it look? How does it act when looking to see if the "coast is clear"?

2. When climbing a tree, does it go straight up, or move around the trunk? How does it hide itself behind a tree trunk and observe the passer-by? Describe how it manages to climb a tree? Does it go down the tree head first? Is it able to climb out on the smallest branches? Of what advantage is this to it?

3. Look closely and see if a squirrel follows the same route always when passing from one point to another. How does it pass from tree to tree? How does it act when preparing to jump? How does it hold its legs and tail when in the air during a jump from branch to branch?

4. Describe the colors of the red squirrel above and below. Is there a dark stripe along its side, if so, what color? How does the color of the squirrel protect it from its enemies? Is its color brighter in summer or in winter?

5. How are the squirrel's eyes placed? Do you think it can see behind as well as in front all the time? Are its eyes bright and alert, or soft and tender?

6. Are its legs long or short? Are its hind legs stronger and longer than the front legs? Why? Why does it not need long legs? Does its paws have claws? How does it use its paws when eating and in making its toilet?

7. Describe the squirrel's tail. Is it as long as the body? Is it used to express emotion? Of what use is it when the squirrel is jumping? Of what use is it in the winter in the nest?

8. What is the food of the squirrel during the autumn? Winter? Spring? Summer? Where does it store food for the winter? Does it steal food laid up by jays, chipmunks, mice or other squirrels? How does it carry nuts? Has it cheek-pouches like the chipmunk for carrying food? Does it stay in its nest all winter living on stored food like a chipmunk?

9. Where does the red squirrel make its winter home? Does it also have a summer home, if so, of what is it made and where built? In what sort of a nest are the young born and reared? At what time of the year are the young born? How does the mother squirrel carry her little ones if she wishes to move them?

10. How much of squirrel language can you understand? How does it express surprise, excitement, anger, or joy during the nut harvest? Note how many different sounds it makes and try to discover what they mean.

11. Describe or sketch the tracks made by the squirrel in the snow.

12. How does the squirrel get at the meats of the hickory nut and the walnut? How are its teeth arranged to gnaw holes in such hard substances as shells?

Supplementary reading—Squirrels and Other Fur Bearers, John Burroughs; American Animals, Stone & Cram; Secrets of the Woods, Long; Familiar Life in Field and Forest, Mathews; Little Beasts of Field and Wood; Cram; Wild Neighbors, Ingersoll; Familiar Wild Animals, Lottridge.

FURRY

FURRY was a baby red squirrel. One day in May his mother was moving him from one tree to another. He was clinging with his little arms around her neck and his body clasped tightly against her breast, when something frightened her and in her sudden movement, she dropped her heavy baby in the grass. Thus, I inherited him and entered upon the rather onerous duties of caring for a baby of whose needs I knew little; but I knew that every well cared for baby should have a book detailing all that happens to it, therefore, I made a book for Furry, writing in it each day the things he did. If the children who have pets keep similar books, they will find them most interesting reading afterward, and they will surely enjoy the writing very much.

Extracts from Furry's Note-book

May 18, 1902—The baby squirrel is just large enough to cuddle in one hand. He cuddles all right when once he is captured; but he is a terrible fighter, and when I attempt to take him in my hand, he scratches and bites and growls so that I have been obliged to name him Fury. I told him, however, if he improved in temper I would change his name to Furry.

May 19—Fury greets me, when I open his box, with the most awe-inspiring little growls, which he calculates will make me turn pale with fear. He has not cut his teeth yet, so he cannot bite very severely, but that isn't his fault, for he tries hard enough. The Naturalist said cold milk would kill him, so I warmed the milk and put it in a teaspoon and placed it in front of his nose; he batted the spoon with both forepaws and tried to bite it, and thus got a taste of the milk, which he drank eagerly lapping it up like a kitten. When I hold him in one hand and cover him with the other, he turns contented little somersaults over and over.

May 20—Fury bit me only once to-day, when I took him out to feed him. He is cutting his teeth on my devoted fingers. I tried giving him grape-nuts soaked in milk, but he spat it out in disgust. Evidently he does not believe he needs a food for brain and nerve. He always washes his face as soon as he is through eating.

May 21—Fury lies curled up under his blanket all day. Evidently good little squirrels stay quietly in the nest, when the mother is not at home to give them permission to run around. When Fury sleeps, he rolls himself up in a little ball with his tail wrapped closely around him. The squirrel's tail is his "furs," which he wraps around him to keep his back warm when he sleeps in winter.

May 23—Every time I meet Uncle John he asks, "Is his name Fury or Furry now?" Uncle John is much interested in the good behavior of even little squirrels. As Fury has not bitten me hard for two days, I think I will call him Furry after this. He ate some bread soaked in milk to-day, holding it in his hands in real squirrel fashion. I let him run around the room and he liked it.

May 25—Furry got away from me this morning and I did not find him for an hour. Then I discovered him in a pasteboard box of drawing paper with the cover on. How did he squeeze through?

May 26—He holds the bowl of the spoon with both front paws while he drinks the milk. When I try to draw the spoon away, to fill it again after he has emptied it, he objects and hangs on to it with all his little might, and scolds as hard as ever he can. He is such a funny, unreasonable baby.

May 28—To-night I gave Furry a walnut meat. As soon as he smelled it he became greatly excited; he grasped the meat in his hands and ran off and hid under my elbow, growling like a kitten with its first mouse.

May 30—Since he tasted nuts he has lost interest in milk. The nut meats are too hard for his new teeth, so I mash them and soak them in water and now he eats them like a little piggy-wig with no manners at all. He loves to have me stroke his back while he is eating. He uses his thumbs and fingers in such a human way that I always call his front paws *hands*. When his piece of nut is very small he holds it in one hand and clasps the other hand behind the one which holds the dainty morsel, so as to keep it safe.

May 31—When he is sleepy he scolds if I disturb him and turning over on his back bats my hand with all of his soft little paws and pretends that he is going to bite.

June 4—Furry ranges around the room now to please himself. He is a little mischief; he tips over his cup of milk and has commenced gnawing off the wall paper behind the book-shelf to make him a nest. The paper is green and will probably make him sorry.

June 5—This morning Furry was hidden in a roll of paper. I put my hand over one end of the roll and then reached in with the other hand to get him; but he got me instead, because he ran up my sleeve and was much more contented to be there than I was to have him. I was glad enough when he left his hiding place and climbed to the top shelf of the bookcase, far beyond my reach.

June 6—I have not seen Furry for twenty-four hours, but he is here surely enough. Last night he tipped over the ink bottle and scattered nut shells over the floor. He prefers pecans to any other nuts.

June 7—I caught Furry to-day and he bit my finger so it bled. But afterwards, he cuddled in my hand for a long time, and then climbed my shoulder and went hunting around in my hair and wanted to stay there and make a nest. When I took him away, he pulled out his two hands full of my devoted tresses. I'll not employ him as a hairdresser.

June 9—Furry sleeps nights in the top drawer of my desk; he crawls in from behind. When I pull out the drawer he pops out and scares me nearly out of my wits; but he keeps his wits about him and gets away before I can catch him.

June 20—I keep the window open so Furry can run out and in and learn to take care of himself out-of-doors.

Furry soon learned to take care of himself, though he often returned for nuts, which I kept for him in a bowl. He does not come very near me out-of-doors, but he often speaks to me in a friendly manner from a certain pitch pine tree near the house.

There are many blank leaves in Furry's note-book. I wish that he could have written on these of the things that he thought about me and my performances. It would certainly have been the most interesting book concerning squirrels in the world.

THE CHIPMUNK

Teacher's Story

WHILE the chipmunk is a good runner and jumper, it is not so able a climber as is the red squirrel, and it naturally stays nearer the ground. One windy day I was struck by the peculiar attitude of what, I first thought, was a red squirrel gathering green acorns from a chestnut oak in front of my window. A second glance showed me that it was a chipmunk lying close to the branch, hanging on for "dear life" and with an attitude of extreme caution, quite foreign to the red squirrel in a similar situation. He would creep out, seize an acorn in its teeth, creep back to a larger limb, take off the shell, and with his little paws stuff the kernel into his cheek pouches; he took hold of one side of his mouth with one hand to stretch it out, as if opening a bag, and stuffed the acorn in with the other. I do not know whether this process was necessary or not at the beginning, for his cheeks were distended when I first saw him; and he kept on stuffing them until he looked as if he had a hopeless case of mumps. Then with obvious care he descended the tree and retreated to his den in the side hill, the door of which I had already discovered, although it was well hidden by a bunch of orchard grass.

Chipmunks are more easily tamed than red squirrels and soon learn that pockets may contain nuts and other things good to eat. The first tame chipmunk of my acquaintance belonged to a species found in the California mountains. He was a beautiful little creature and loved to play about his mistress' room; she being a naturalist as well as a poet, was able to understand her little companion, and the relations between them were full of mutual confidence. He was fond of English walnuts and would always hide away all that were placed in a dish on the table. One day his mistress, when taking off her bonnet after returning from church, discovered several of these nuts tucked safely in the velvet bows; they were invisible from the front but perfectly visible from the side. Even yet, she wonders what the people at church that day thought of her original ideas in millinery; and she wonders still more how "Chipsie" managed to get into the bonnet-box, the cover of which was always carefully closed.

"Chipsie", a chipmunk of the Sierras.

The chipmunk is a good home builder and carries off, presumably in its cheek pouches, all of the soil which it removes in making its burrow. The burrow is made usually in a dry hillside, the

passageway just large enough for its own body, widening to a nest which is well bedded down. There is usually a back door also, so that in case of necessity, the inmate can escape. It retires to this nest in late November and does not appear again until March. In the nest, it stores nuts and other grains so that when it wakens, at long intervals, it can take refreshment.

If you really wish to know whether you see what you look at or not, test yourself by trying to describe the length, position and number of the chipmunk's stripes. These stripes, like those of the tiger in the jungle, make the creature less conspicuous; when on the ground, where its stripes fall in with the general shape and color of the grass and underbrush, it is quite invisible until it stirs. Its tail is not so long nor nearly so bushy as that of the squirrel; it does not need a tail to balance and steer with in the tree tops; and since it lives in the ground, a bushy tail would soon be loaded with earth and would be an incubus instead of a thing of beauty.

The chipmunk is not a vocalist like the red squirrel, but he can cluck like a cuckoo and chatter gayly or cogently; and he can make himself into a little bunch with his tail curved up his back, while he eats a nut from both his hands, and is even more amusing than the red squirrel in this attitude; probably because he is more innocent and not so much of a *poseur*. His food consists of all kinds of nuts, grain and fruit, but he does little or no damage, as a rule. He is pretty and distinctly companionable, and I can rejoice, in that I have had him and his whole family as my near neighbors for many years. I always feel especially proud when he shows his confidence, by scampering around our piazza floor and peeping in at our windows, as if taking a reciprocal interest in us.

LESSON LVIII

The Chipmunk

Leading thought—The chipmunk lives more on the ground than does the squirrel; its colors are protective and it has cheek pouches in which it carries food, and also soil when digging its burrow. It stores food for winter in its den.

Method—The field note-book should be the basis for this work. Give the pupils an outline of observations to be made, and ask for reports now and then. Meanwhile stimulate interest in the little creatures by reading aloud from some of the references given.

Observations—1. Do you see the chipmunk climbing around in trees like the red squirrel? How high in a tree have you ever seen a chipmunk?

2. What are the chipmunk's colors above and below? How many stripes has it? Where are they and what are their colors? Do you think that these stripes conceal the animal when among grasses and bushes?

3. Compare the tails of the chipmunk and the red squirrel. Which is the longer and bushier? Tell if you can the special advantage to the chipmunk in having this less bushy tail?

4. What does the chipmunk eat? How does it carry its food? How does it differ in this respect from the red squirrel? Does it store its food for winter use? How does it prepare its nuts? How does it hold its food while eating?

5. Where does the chipmunk make its home? How does it carry away soil from its burrow? How many entrances are there? How is the den arranged inside? Does it live in the same den the year round? When does it retire to its den in the fall? When does it come out in the spring?

6. Does the chipmunk do any damage to crops? What seeds does it distribute? At what time do the little chipmunks appear in the spring?

7. Observe carefully the different tones of the chipmunk and compare its chattering with that of the squirrel.

Supplementary reading—Squirrels and Other Fur-Bearers, John Burroughs; American Animals, Stone and Cram.

Photo by Verne Morton

The Eastern Chipmunk.

TO A CAPTIVE CHIPMUNK OF THE SIERRAS

Bright little comrade from the woods, come show
Thy antic cheer about my sunlit room
Of books, that stand in moods of gloom
Because thought's tide is out, heart's rhythm is low
With weariness. Friendly thou art and know
Good friend in me, who yet did dare presume
To take thee from thy home, thy little doom
To make for thee, and longer life bestow.
So, thou hast not been eaten by the snake;
Thy gentle blood no weasel drank at night;
Thou hast not starved 'mid winter's frozen wood,
Nor waited vainly for the sun to make
Sweet the wild nuts for thee. Yet, little sprite,
Thou still doth question if my deed were good?

—Irene Hardy.

THE LITTLE BROWN BAT

Teacher's Story

His small umbrella, quaintly halved,
Describing in the air an arc alike inscrutable,—
Elate philosopher!—EMILY DICKENSON.

WHOEVER first said "as blind as a bat," surely never looked a bat in the face, or he would not have said it. The deep-set, keen, observant eyes are quite in keeping with the alert attitude of the erect, pointed ears; while the pug-nose and the wide open, little, pink bag of a mouth, set with tiny, sharp teeth, give this anomalous little animal a deliciously impish look. Yet how have those old artists belied the bat, who fashioned their demons after his pattern, ears, eyes, nose, mouth, wings and all! Certain it is, if human beings ever get to be winged angels in this world, they are far more likely to have their wings fashioned like those of the bat than like those of the bird. As a matter of fact, there are no other wings so wonderful as the bat's; the thin membrane is equipped with sensitive nerves which inform the flier of the objects in his path, so that he darts among the branches of trees at terrific speed and never touches a twig; a blinded bat was once set free in a room, across which threads were stretched, and he flew about without ever touching one. After we have tamed one of these little, silky flitter-mice we soon get reconciled to his wings for he proves the cunningest of pets; he soon learns who feeds him, and is a constant source of entertainment.

The flight of the bat is the highest ideal we may have, for the achievement of the aeroplane. It consists of darting hither and thither with incredible swiftness, and making sharp turns with no apparent effort. Swifts and swallows are the only birds that can compete with the bat in wing celerity and agility; it is interesting to note that these birds also catch insects on the wing, for food. The bat, like the swift, keeps his mouth open, scooping in all the insects in his way; more than this, he makes a collecting net of the wing membrane, stretched between the hind legs and tail, doubling it up like an apron on the unfortunate insects, and then reaching down and gobbling them up; and thus he is always doing good service to us on summer evenings by swallowing mosquitoes and gnats.

The short fur of the bat is as soft as silk, and covers the body but not the wings; the plan of the wing is something like that of the duck's foot; it consists of a web stretched between very much elongated fingers. If a boy's fingers were as long in proportion, as a bat's, they would measure four feet. Stretched between the long fingers is a thin, rubbery membrane, which extends back to the ankles and thence back to the tip of the bony tail; thus, the bat has a winged margin all around his body. Since fingers make the framework, it is the thumb that projects from the front angle of the wing, in the form of a very serviceable hook, resembling that used by a one-armed man to replace the lost member. These hooks the bat uses in many ways. He drags himself along the floor with their aid, or he scratches the back of his head with them, if occasion requires. He is essentially a creature of the air and is not at all fitted for walking; his

knees bend backward in an opposite direction from ours. This renders him unable to walk, and when attempting to do so, he has the appearance of "scrabbling" along on his feet and elbows. When thus moving he keeps his wings fluttering rapidly, as if feeling his way in the dark, and his movements are trembly. He uses his teeth to aid in climbing.

The little brown bat's wings often measure nine inches from tip to tip, and yet he folds them so that they scarcely show, he does not fold them like a fan, but rather like a pocket knife. The hind legs merely act as a support for the side wing, and the little hip bones look pitifully sharp; the membrane reaches only to the ankle, the tiny emaciated foot projecting from it is armed with five, wirelike toes, tipped with sharp hooked claws. It is by these claws that he hangs when resting during the day, for he is upside-down-y in his sleeping habits, slumbering during the daytime, while hanging head downward, without any inconvenience from a rush of blood to the brain; when thus suspended, the tail is folded down. Sometimes he hangs by one hind foot and a front hook; and he is a wee thing when all folded together and hung up, with his nose tucked between his hooked thumbs, in a very babyish fashion.

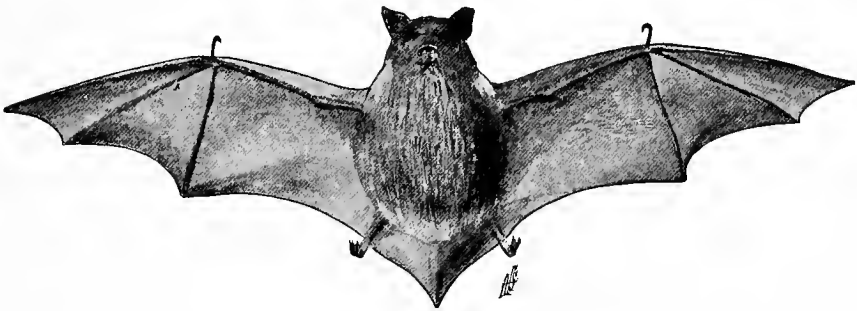
The bat is very particular about his personal cleanliness. People who regard the bat as a dirty creature, had better look to it that they are even half as fastidious as he. He washes his face with the front part of his wing, and then licks his wash-cloth clean; he scratches the back of his head with his hind foot and then licks the foot; when hanging head down, he will reach one hind foot down and scratch behind his ear with an *aplomb* truly comical in such a mite; but it is most fun of all to see him clean his wings; he seizes the edges in his mouth and stretches and licks the membrane until we are sure it is made of silk elastic, for he pulls and hauls it in a way truly amazing.

The bat has a voice which sounds like the squeak of a toy wheelbarrow, and yet it is expressive of emotions. He squeaks in one tone when holding conversation with other bats, and squeaks quite differently when seized by the enemy.

The mother bat feeds her little ones from her breasts as a mouse does its young, only she cradles them in her soft wings while so doing; often she takes them with her when she goes out for insects in the evenings; they cling to her neck during these exciting rides; but when she wishes to work unencumbered, she hangs her tiny youngsters on some twig and goes back to them later. The little ones are born in July and usually occur as twins. During the winter, bats hibernate like woodchucks or chipmunks. They select for winter quarters some hollow tree or cave or other protected place. They go to sleep when the cold weather comes, and do not awake until the insects are flying; they then come forth in the evenings, or perhaps early in the morning, and do their best to rid the world of mosquitoes and other insect nuisances.

There are many senseless fears about the bat; for instance, that he likes to get tangled in a lady's tresses, a situation which would frighten him far more than the lady; or that he brings bedbugs into the house, when he enters on his quest for mosquitoes, which is an ungrateful slander. Some people believe that all bats are vampires, and only await an opportunity to suck blood from their victims. It is true that in South America there are two species which occasionally attack people who are careless enough to sleep with their toes uncovered, but feet thus injured seem to

recover speedily; and these bats do little damage to people, although they sometimes pester animals; but there are no vampires in the United States. Our bats, on the contrary, are innocent and beneficial to man; and if we had more of them we should have less malaria. There a few species in our country, which have little, leaf-like growths on the end of the nose; and when scientists study the bat from a nature-study instead of an anatomical standpoint, we shall know what these leafy appendages are used for.



The little brown bat.

LESSON LIX

The Bat

Leading thought—Although the bat's wings are very different from those of the bird's yet it is a rapid and agile flier. It flies in the dusk and catches great numbers of mosquitoes and other troublesome insects, upon which it feeds.

Method—This lesson should not be given unless there is a live bat to illustrate it; the little creature can be cared for comfortably in a cage in the schoolroom, as it will soon learn to take flies or bits of raw meat when presented on the point of a pencil or toothpick. Any bat will do for this study, although the little brown bat is the one on which my observations were made.

Observations—1. At what time of day do we see bats flying? Describe how the bat's flight differs from that of birds. Why do bats dart about so rapidly?

2. Look at a captive bat and describe its wings. Can you see what makes the framework of the wings? Do you see the three finger bones extending out into the wings? How do the hind legs support the wing? The tail? Is the wing membrane covered with fur? Is it thick and leathery or thin and silky and elastic? How does the bat fold up its wings?

3. In what position does the bat rest? Does it ever hang by his thumb hooks?

4. Can you see whether the knees of the hind legs bend upward or downward? How does the bat act when trying to walk or crawl? How does it use its thumb hooks in doing this?

5. What does the bat do daytimes? Where does it stay during the day? Do many bats congregate together in their roosts?

6. Describe the bat's head, including the ears, eyes, nose and mouth. What is its general expression? Do you think it can see and hear well? How is its mouth fitted for catching insects? Does it shut its mouth while chewing or keep it open? Do you think that bats can see by daylight?

7. What noises does a bat make? How does it act if you try to touch it? Can it bite severely? Can you understand why the Germans call it a flitter-mouse?

8. Do you know how the mother bat cares for her young? How does she carry them? At what time of year may we expect to find them?

9. When making its toilet, how does a bat clean its wings? Its face? Its back? Its feet? Do you know if it is very clean in his habits?

10. How and where do the bats pass the winter? How are they beneficial to us? Are they ever harmful?

Supplementary reading—American Animals, Stone and Cram.

Nature-study should not be unrelated to the child's life and circumstances. It stands for directness and naturalness. It is astonishing when one comes to think of it, how indirect and how remote from the lives of pupils much of our education has been. Geography still often begins with the universe, and finally, perhaps, comes down to some concrete and familiar object or scene that the pupil can understand. Arithmetic has to do with brokerage and partnerships and partial payments and other things that mean nothing to the child. Botany begins with cells and protoplasm and cryptogams. History deals with political and military affairs, and only rarely comes down to physical facts and to those events that express the real lives of the people; and yet political and social affairs are only the results of expressions of the way in which people live. Readers begin with mere literature or with stories of scenes the child will never see. Of course these statements are meant to be only general, as illustrating what is even yet a great fault in educational methods. There are many exceptions, and these are becoming commoner. Surely, the best education is that which begins with the materials at hand. A child knows a stone before it knows the earth.

—L. H. Bailey in "The Nature-Study Idea."

THE SKUNK

Teacher's Story

THOSE who have had experience with this animal, surely are glad that it is small; and the wonder always is, that so little a creature can make such a large impression upon the atmosphere. A fully grown skunk is about two feet long; its body is covered with long, shining, rather coarse hair, and the tail which is carried like a flag in the air, is very large and bushy. In color, the fur is sometimes entirely black, but most often has a white patch on the back of the neck, with two stripes extending down the back and along the sides to the tail; the face, also, has a white stripe.

The skunk has a long head and a rather pointed snout; its front legs are very much shorter than its hind legs, which gives it a very peculiar gait. Its forefeet are armed with long, strong claws, with which it digs its burrow, which is usually made in light soil. It also often makes its home in some crevice in rocks, or even takes possession of an abandoned woodchuck's hole; or trusting to its immunity from danger, makes its home under the barn. In the fall, it becomes very fat, and during the early part of winter, hibernates within its den; it comes out during the thaws of winter and early spring.

The young skunks appear in May; they are born in an enlarged portion of the burrow, where a nice bed of grass and leaves is made for them; the skunk is scrupulously neat about its own nest. The young skunks are very active, and interesting to watch, when playing together like kittens.

The skunk belongs to the same family as the mink and weasel, which also give off a disagreeable odor when angry. The fetid material which is the skunk's defence, is contained in two capsules under the root of the tail. These little capsules are not larger than peas, and the quantity of liquid forced from them in a discharge is scarcely more than a large drop; yet it will permeate the atmosphere with its odor for a distance of a mile. The fact that this discharge is so disagreeable to all other animals, has had a retarding influence upon the skunk's intelligence. It has not been obliged to rely upon its cunning to escape its enemies, and has therefore never developed either fear or cleverness. It marches abroad without haste, confident that every creature which sees it will give it plenty of room. It is a night prowler, although it is not averse to a daytime promenade. The white upon its fur gives warning at night, that here is an animal which had best be left alone. This immunity from attack makes the skunk careless in learning

Photo by Verne Morton

The skunk.

wisdom from experience; it never learns to avoid a trap or a railway or trolley track.

The skunk's food consists largely of insects, mice, snakes and other small animals. It also destroys the eggs and young of birds which nest upon the ground. It uses its strong forepaws in securing its prey. Dr. Merriam, who made pets of young skunks after removing their scent capsules, found them very interesting. He says of one which was named "Meph": "We used to walk through the woods to a large meadow that abounded in grasshoppers. Here, Meph would fairly revel in his favorite food, and it was rich sport to watch his manœuvres. When a grasshopper jumped, he jumped, and I have seen him with as many as three in his mouth and two under his fore-paws at the same time."

The only injury which the skunk is likely to do to the farmers, is the raiding of the hens' nests, and this can be obviated by properly housing the poultry. On the other hand, the skunk is of great use in destroying injurious insects and mice. Often when skunks burrow beneath barns, they completely rid the place of mice. Skunk fur is very valuable and is sold under the name of Alaskan sable. The skunk takes short steps, and goes so slowly that it makes a double track, the imprints being very close together. The foot makes a longer track than that of the cat, as the skunk is plantigrade; that is, it walks upon its palms and heels as well as its toes.

Skunk tracks.

References—Wild Neighbors, Ingersoll; Familiar Life in Field and Forest, Mathews; American Animals, Stone and Cram; Squirrels and Other Fur Bearers, Burroughs.

LESSON LX

The Skunk

Leading thought—The skunk has depended so long upon protecting itself from its enemies by its disagreeable odor, that it has become stupid in this respect, and seems never to be able to learn to keep off of railroad tracks. It is a very beneficial animal to the farmer because its food consists so largely of injurious insects and rodents.

Method—The questions should be given the pupils and they should answer them from personal observations or inquiries.

Observations—1. How large is a skunk? Describe its fur. Where does the black and white occur in the fur? Of what use is the white to the skunk? Is the fur valuable? What is its commercial name?

2. What is the shape of the skunk's head? The general shape of the body? The tail? Are the front legs longer or shorter than the hind legs? Describe the front feet. For what are they used?

3. Where and how does the skunk make its nest? Does it sleep like a woodchuck during the winter? What is its food? How does it catch its prey? Does it hunt for its food during the day or the night? Does

the skunk ever hurry? Is it afraid? How does it protect itself from its enemies? Do you think that the skunk's freedom from fear has rendered the animal less intelligent?

4. At what time do the skunk kittens appear? Have you ever seen little skunks playing? If so, describe their antics. How is the nest made soft for the young ones?

5. How does the skunk benefit farmers? Does it ever do them any injury? Do you think that it does more good than harm?

6. Describe the skunk's track as follows: How many toes show in the track? Does the palm or heel show? Are the tracks near together? Do they form a single or a double line?

Supplementary reading—Squirrels and Other Fur Bearers, Burroughs.

Saw a little skunk coming up the river bank in the woods at the white oak, a funny little fellow, about six inches long and nearly as broad. It faced me and actually compelled me to retreat before it for five minutes. Perhaps I was between it and its hole. Its broad black tail, tipped with white, was erect like a kitten's. It had what looked like a broad white band drawn tight across its forehand or top-head, from which two lines of white ran down, one on each side of its back, and there was a narrow white line down its snout. It raised its back, sometimes ran a few feet forward, sometimes backward, and repeatedly turned its tail to me, prepared to discharge its fluid, like the old ones. Such was its instinct, and all the while it kept up a fine grunting like a little pig or a red squirrel.—Henry Thoreau.

Few animals are so silent as the skunk. Zoological works contain no information as to its voice, and the essayists rarely mention it except by implication. Mr. Burroughs says: "The most silent creature known to me, he makes no sound, so far as I have observed, save a diffuse, impatient noise, like that produced by beating your hand with a whisk-broom, when the farm-dog has discovered his retreat in the stone fence." Rowland Robinson tells us that: "The voiceless creature sometimes frightens the belated farm-boy, whom he curiously follows with a mysterious hollow beating of his feet upon the ground." Thoreau, as has been mentioned, heard one keep up a "fine grunting, like a little pig or a squirrel;" but he seems to have misunderstood altogether a singular loud patting sound heard repeatedly on the frozen ground under the wall, which he also listened to, for he thought it "had to do with getting its food, patting the earth to get the insects or worms." Probably he would have omitted this guess if he could have edited his diary instead of leaving that to be done after his death. The patting is evidently merely a nervous sign of impatience or apprehension, similar to the well-known stamping with the hind feet indulged in by rabbits, in this case probably a menace like a doubling of the fists, as the hind legs, with which they kick, are their only weapons. The skunk, then, is not voiceless, but its voice is weak and querulous, and it is rarely if ever heard except in the expression of anger.

—Ernest Ingersol in "Wild Neighbors."

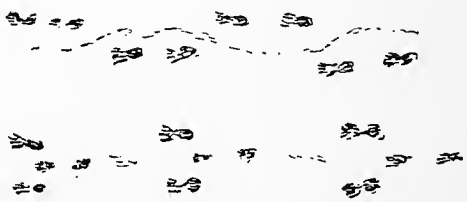
The raccoon.
Photo by George Fiske, Jr.

THE RACCOON

Teacher's Story

ONE other of our little brothers of the forest, has such a mischievous countenance as the coon. The black patch across the face and surrounding the eyes, like large goggles, and the black line extending from the long, inquisitive nose directly up the forehead give the coon's face an anxious expression; and the keenness of the big, beady, black eyes and the alert, "sassy" looking, broadly triangular ears, convince one that the anxiety depicted in the face is anxiety lest something that should *not* be done be left undone; and I am sure that anyone who has had experience with pet coons will aver that their acts do not belie their looks.

What country child, wandering by the brook and watching its turbulence in early spring, has not viewed with awe, a footprint on the muddy banks looking as if it were made by the foot of a very little baby. The first one I ever saw, I promptly concluded was made by the



Coon tracks.
1 Walking 2 Jumping

foot of a brook fairy. However, the coon is no fairy; it is a rather heavy, logy animal and, like the bear and skunk, is plantigrade, walking on the entire foot instead of on the toes, like a cat or dog. The hind foot is long, with a well-marked heel, and five comparatively short toes, giving it a remarkable resemblance to a human foot. The front foot is smaller and looks like a wide, little hand, with four long fingers and a rather short thumb. The claws are strong and sharp. The soles of the feet and the palms of the hands look as if they were covered with black kid, while the feet above and the backs of the hands are covered with short fur. Coon tracks are likely to be found during the first thawing days of winter, along some stream or the borders of swamps, often following the path made by cattle. The full-length track is about 2 inches long; as the coon puts the hind foot in the track made by the front foot on the same side, only the print of the hind feet is left, showing plainly five toe prints and the heel. The tracks may vary from one-half inch to one foot or more apart, depending on how fast the animal is going; when it runs it goes on its toes, but when walking sets the heel down; the tracks are not in so straight a line as those made by the cat. Sometimes it goes at a slow jump, when the prints of the hind feet are paired, and between and behind them are the prints of the two front feet.

The coon is covered with long, rather coarse hair, so long as to almost drag when the animal is walking; it really has two different kinds of hair, the long, coarse, gray hair, blackened at the tips, covering the fine, short, grayish or brownish under coat. The very handsome bushy tail is ringed with black and gray.

The raccoon feeds on almost anything eatable, except herbage. It has a special predilection for corn in the milk stage and, in attaining this sweet and toothsome luxury, it strips down the husks and often breaks the plant, doing much damage. It is also fond of poultry and often raids hen houses; it also destroys birds' nests and the young, thus damaging the farmer by killing both domestic and wild birds. It is especially fond of fish and is an adept at sitting on the shore and catching them with its hands; it likes turtle eggs, crayfish and snakes; it haunts the bayous of the Gulf Coast for the oysters which grow there; it is also a skillful frog catcher. Although fond of animal diet, it is also fond of fruit, especially of berries and wild grapes.

It usually chooses for a nest a hollow tree or a cavern in a ledge near a stream, because of its liking for water creatures; and also because of its strange habit of washing its meat before eating it. I have watched a pet coon performing this act; he would take a piece of meat in his hands, dump it into the pan of drinking water and souse it up and down a few times; then he would get into the pan with his splay feet and roll the meat beneath and between them, meanwhile looking quite unconcernedly at his surroundings, as if washing the meat were an act too mechanical to occupy his mind. After the meat had become soaked until white and flabby, he would take it in his hands and hang on to it with a tight grip while he pulled off pieces with his teeth; or sometimes he would hold it with his feet, and use hands as well as teeth in tearing it apart. The coon's teeth are very much like those of the cat, having long, sharp tushes or canines, and sharp, wedge-shaped grinding teeth, which cut as well as grind. After eating, the pet coon always washed his feet by splashing them in the pan.

It is a funny sight to watch a coon arrange itself for a nap, on a branch or in the fork of a tree; it adapts its fat body to the unevenness of the bed with apparent comfort; it then tucks its nose down between its paws and curls its tail about itself, making a huge, furry ball. In all probability, the rings of gray and black on the tail, serve as protective color to the animal sleeping in a tree during the daytime, when sunshine and shadow glance down between the leaves with ever-changing light. The coon spends much of its days asleep in some such situation, and comes forth at night to seek its food.

In the fall, the coon lays on fat enough to last it during its winter sleep. Usually several inhabit the same nest in winter, lying curled up together in a hollow tree, and remaining dormant all winter except when awakened by the warmth of a thaw. They then may come forth to see what is happening, but return shortly to wait until March or April; then they issue to hunt for the scant food, and are so lean and weak that they fall easy prey to their enemies.

The young are born in April and May; there are from three to six in a litter; they are blind and helpless at first, and are cared for carefully by their parents, the family remaining together for a year, until the young are fully grown. If removed from their parents the young ones cry pitifully, almost like babies. The cry or whistle of the fully grown coon is anything but a happy sound, and is quite impossible to describe. I have been awakened by it many a night in camp, and it always sounded strange, taking on each time new quavers and whimperings. As a cry, it is first cousin to that of the screech-owl.

The stories of pet coons are many. I knew one which, chained in a yard, would lie curled up near its post looking like an innocent stone except for one eye kept watchfully open. Soon a hen, filled with curiosity would come warily near, looking longingly at remains of food in the pan; the coon made no move until the disarmed biddy came close to the pan. Then, there was a scramble and a squawk and with astonishing celerity he would wring her neck and strip off her feathers. Another pet coon was allowed to range over the house at will, and finally had to be sent away because he had learned to open every door in the house, including cupboard doors, and could also open boxes and drawers left unlocked; and I have always believed he could have learned to unlock drawers if he had been given the key. All coons are very curious, and one way of trapping them is to suspend above the trap a bit of bright tin; in solving this glittering mystery, traps are forgotten.

LESSON LXI

The Raccoon

Leading thought—The raccoon lives in hollow trees or caves along the banks of streams. It sleeps during the day and seeks its food at night. It sleeps during the winter.

Method—If there are raccoons in the vicinity, ask the older boys to look for their tracks rear the streams and to describe them very carefully to the class. The ideal method of studying the animal, is to have a pet coon where the children may watch at leisure its entertaining and funny performances. If this is impossible, then follow the

less desirable method of having the pupils read about the habits of the coon and thus arouse their interest and open their eyes, so that they may make observations of their own when opportunity offers. I would suggest the following topics for oral or written work in English:

"How and Where Coons Live and What They Do;" "The Autobiography of a Coon One Year Old;" "The Queer Antics of Pet Coons;" "Stories of the Coon's Relative, the Bear."

Treed.

Observations—1. Where have you found raccoon tracks? How do they differ from those of fox or dog? How far are the footprints apart? Can you see the heel and toe prints? Do you see the tracks of all four feet? Are the tracks in a straight line like those of the cat? What is the size of the track, the length, the breadth?

2. What do coons eat and how do they get their food? Which of our crops are they likely to damage? What other damage do they do? Have you ever heard coons cry or whistle during August nights in the cornfields?

3. Why do raccoons like to live near the water? What do they find of interest there? How do they prepare their meat before eating it? How does a coon handle its meat while eating it?

4. What kind of fur has the coon? Why does it need such a heavy covering? Describe the color of the fur. Describe the tail. Of what use is such a large and bushy tail to this animal?

5. Describe the coon's face. How is it marked? What is its expression? Describe the eyes and ears. The nose. Has it teeth resembling those of the cat and dog?

6. Describe the coon's feet. How many toes on the front feet? How many on the hind feet? How does this differ from the cat and dog? How do the front and hind feet differ in appearance? Can both be used as hands?

7. How do coons arrange themselves for a nap in a tree? How do they cover the head? How is the tail used? Do you think this bushy tail used in this way would help to keep the animal warm in winter? Do coons sleep most daytimes or nights?

8. At what time of year are coons fattest? Leanest? Why? Do they ever come out of their nests in winter? Do they live together or singly in winter?

9. At what time of year are the young coons born? Do you know how they look when they are young? How are they cared for by their parents?

10. Are the coon's movements slow or fast? What large animal is a near relative of the coon?

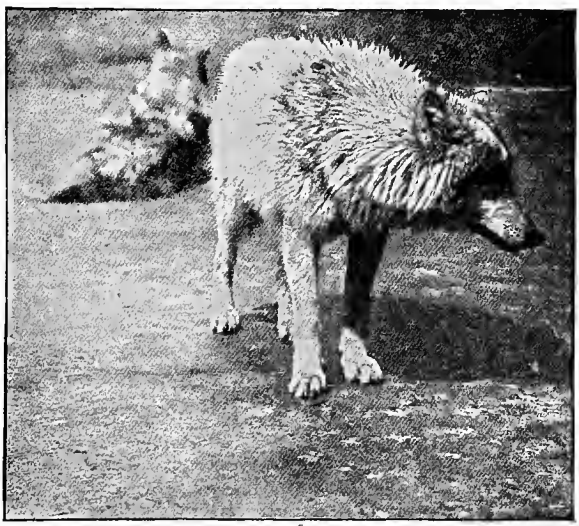
Supplementary reading—American Animals, Stone and Cram; Wild Neighbors, Ingersoll; Familiar Life of Field and Forest, Mathews; Little People of the Sycamore, Roberts; Life of Animals, Ingersoll; "Mux" in Roof and Meadow, Sharp; Little Brother of the Bear, Long.

Professor Fred S. Charles and his pet coon, "Dick".

THE WOLF

THE study of the wolf should precede the lessons on the fox and the dog. After becoming familiar with the habits of wolves, the pupils will be much better able to understand the nature of the dog and its life as a wild animal. In most localities, the study of the wolf must, of course, be a matter of reading, unless the pupils have an opportunity to study the animal in traveling manageries or in zoological gardens. However, in all the government preserves, the timber wolf has multiplied to such an extent, that it may become a factor in the lives of many people in the United States. This wolf ranged in packs over New York State a hundred years ago, but was finally practically exterminated in most of the eastern forests, except in remote and mountainous localities. A glance at Bulletin 72 by Vernon Bailey, published by the U. S. Department of Agriculture, Forest Service, is a revelation of the success of the timber wolf, in coming back to his own, as soon as the forest preserves furnished plenty of game, and forbade hunters. Timber wolves are returning of late years to Western Maine and Northern New Hampshire; Northern Michigan and Wisconsin have them in greater numbers; some have also been killed in the Apalachian Mountains of Tennessee, Virginia and West Virginia, but their stronghold is in the great Rocky Mountain Region and the Northwestern Sierras, from which they have never been driven.

It might be well to begin this lesson on the wolf with a talk about the gray wolves which our ancestors had to contend with, and also with stories of the coyote or prairie wolf which has learned to adapt itself to civilization and flourishes in the regions west of the Rocky Mountains, despite men and dogs. Literature is rich in wolf stories. Although Kipling's famous Mowgli Stories belong to the realm of fiction, yet they contain interesting accounts of the habits of the wolves of India, and are based upon the hunter's and track-



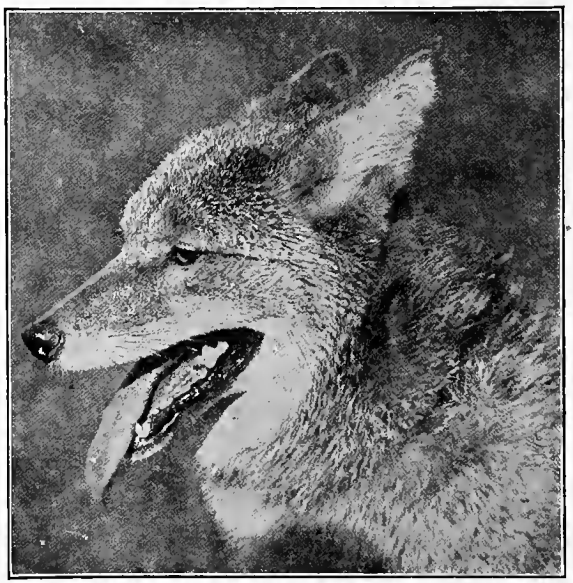
Gray Wolf

er's knowledge of these animals. We have many thrillingly interesting stories in our own literature which deal with our native wolves. The following are among the best:

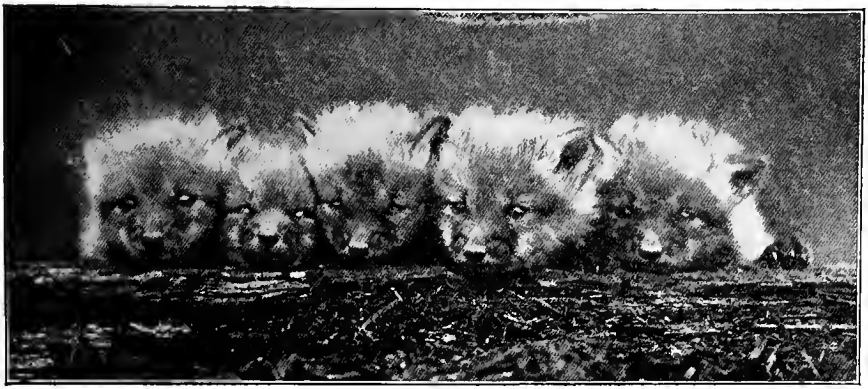
"Lobo" in Wild Animals I Have Known; "Tito" in Lives of the Hunted; "Bad Lands Billy and the Winnipeg Wolf" in Animal Heroes all by Thompson Seton; "The Passing of Black Whelps" in Watchers of the Trail by Roberts; Northern Trails by Long; "Pico, Coyote" by Coolidge in True Tales of Birds and Beasts.

For more serious accounts of the wolves see American Animals, p. 277; The "Hound of the Plains," in Wild Neighbors, and page 188 in the Life of Animals, both by Ingersoll. "The Coyote" by Bret Harte and "The Law of the Pack" in the Second Jungle Book bring the wolf into poetry.

From some or all of these stories, the pupils should get information about the habits of the wolves. This information should be incorporated in an essay or an oral exercise and should cover the following points: Where do the wolves live? On what do they feed? How do they get their prey? Do they hunt alone or in packs? How do they call to each other? Description of the den where the young are reared. The wolf's cleverness in eluding hunters and traps.



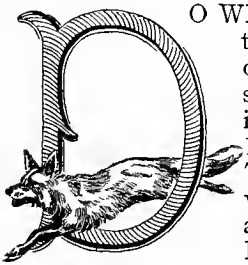
"Katrina Wolfchen", the pet coyote of Professor Fred S. Charles.



Fox cubs.

THE FOX

Teacher's Story



DO WE not always, on a clear morning of winter, feel a thrill that must have something primitive in its quality, at seeing certain tracks in the snow that somehow suggest wildness and freedom! Such is the track of the fox. Although it is somewhat like that of a small dog yet it is very different. The fox has longer legs than most dogs of his weight, and there is more of freedom in his track and more of strength and agility expressed in it. His gait is usually an easy lope; this places the imprint of three feet in a line, one ahead of another, but the fourth is off a little at one side, as if to keep the balance.

The fox lives in a den or burrow. The only fox home which I ever saw, was a rather deep cave beneath the roots of a stump, and there was no burrow or retreat beyond it. However, foxes often select woodchuck burrows, or make burrows of their own, and if they are caught within, they can dig rapidly, as many a hunter can attest. The mother usually selects an open place for a den for the young foxes; often an open field or side-hill is chosen for this. The den is carpeted with grass and is a very comfortable place for the fox puppies. The den of the father fox is usually not far away.

The face of the red fox shows plainly why he has been able to cope with man, and thrive despite and because of him. If ever a face showed cunning, it is his. Its pointed, slender nose gives it an expression of extreme cleverness, while the width of the head between the upstanding, triangular ears gives room for a brain of power. In color the fox is russet-red, the hind quarters being grayish. The legs are black outside and white inside; the throat is white, and the broad, triangular ears are tipped with black. The glory of the fox is his "brush," as the beautiful, bushy tail is called. This is red, with black toward the end and white-tipped. This tail is not merely for beauty, for it affords the fox warmth during the winter, as any one may see who has observed the way it is wrapped

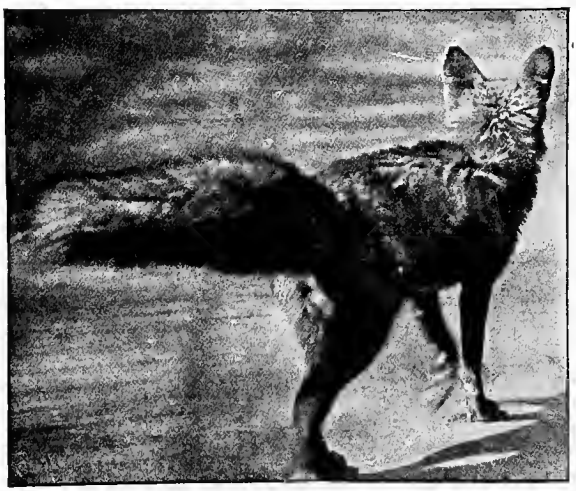
around the sleeping animal. But this bushy tail is a disadvantage, if it becomes bedraggled and heavy with snow and sleet, when the hounds are giving close chase to its owner. The silver fox and the black fox are the same species as the red fox.

The fox is an inveterate hunter of the animals of the field; meadow mice, rabbits, woodchucks, frogs, snakes and grasshoppers, are all acceptable food; he is also destructive of birds. His fondness for the latter has given him a bad reputation with the farmer because of his attacks on poultry. Not only will he raid hen-roosts if he can force entrance, but he catches many fowls in the summer when they are wandering through the fields. The way he carries the heavy burden of his larger prey shows his cleverness: He slings a hen or a goose over his shoulders, keeping the head in his mouth to steady the burden. Mr. Cram says, in American Animals:

"Yet, although the farmer and the fox are such inveterate enemies, they manage to benefit each other in a great many ways quite unintentionally. The fox destroys numberless field mice and woodchucks for the farmer and in return the farmer supplies him with poultry, and builds convenient bridges over streams and wet places, which the fox crosses oftener than the farmer, for he is as sensitive as a cat about getting his feet wet. On the whole, I am inclined to believe that the fox gets the best part of the exchange, for, while the farmer shoots at him on every occasion, and hunts him with dogs in the winter, he has cleared the land of wolves and panthers, so that foxes are probably safer than before any land was ploughed."

The bark of the fox is a high, sharp yelp, more like the bark of the coyote than of the dog. There is no doubt a considerable range of meaning in the fox's language, of which we are ignorant. He growls when angry, and when pleased he smiles like a dog and wags his beautiful tail.

Many are the wiles of the fox to head off dogs following his track: he often retraces his own steps for a few yards and then makes a long sidewise jump; the dogs go on, up to the end of the trail pocket, and try in vain to get the scent from that point. Sometimes he walks along the top rails of fences or takes the high and dry ridges where the scent will not remain; he often follows roads and beaten paths and also goes around and around in the midst of a herd of cattle, so that his scent is hidden; he crosses



Red Fox.

streams on logs and invents various other devices too numerous and intricate to describe. When chased by dogs, he naturally runs in a circle, probably so as not to be too far from home If there are young ones in the den, the father fox leads the hounds far away, in the next county, if possible. Perhaps one of the most clever tricks of the fox, is to make friends with the dogs. I have known of two instances where a dog and fox were daily companions and playfellows.

The young foxes are born in the spring. They are black at first and are fascinating little creatures, being exceedingly playful and active. Their parents are very devoted to them, and during all their puppyhood, the mother fox is a menace to the poultry of the region, because the necessity is upon her of feeding her rapidly growing litter.

In my opinion, the best story of animal fiction is "Red Fox" by Roberts. Like all good fiction, it is based upon facts and it presents a wholesome picture of the life of the successful fox. "The Silver Fox" by Thompson Seton is another interesting and delightful story. Although the Nights with Uncle Remus could scarcely be called nature stories, yet they are interesting in showing how the fox has become a part of folk-lore.

Fox tracks.

LESSON LXII

The Fox

Leading thought—The red fox is so clever that it has been able, in many parts of our country, to maintain itself despite dogs and men.

Method—This lesson is likely to be given largely from hearsay or reading. However, if the school is in a rural district, there will be plenty of hunters' stories afloat, from which may be elicited facts concerning the cunning and cleverness of the red fox. In such places there is also the opportunity in winter to study fox tracks upon the snow. The lesson may well be given when there are fox tracks for observation. The close relationship between foxes and dogs should be emphasized.

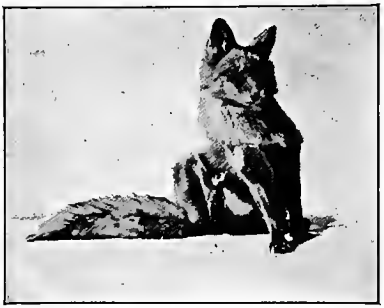
Observations and reading—1. Describe the fox's track. How does it differ from the track of a small dog?

2. Where does the fox make its home? Describe the den. Describe the den in which the young foxes live.

3. Describe the red fox, its color and form as completely as you can. What is the expression of its face? What is there peculiar about its tail? What is the use of this great bushy tail in the winter?

4. What is the food of the fox? How does it get its food? Is it a day or a night hunter? How does the fox benefit the farmer? How does it injure him? How does the fox carry home its heavy game, such as a goose or a hen?

5. Have you ever heard the fox bark? Did it sound like the bark of a dog? How does the fox express anger? Pleasure?



"Got a bite".

6. When chased by dogs, in what direction does the fox run? Describe all of the tricks which you know by which the fox throws the dog off the scent.

7. When are the young foxes born? How many in a litter? What color are they? How do they play with each other? How do they learn to hunt?

Supplementary reading—Red Fox by Roberts; Silver Fox by Thompson Seton; Little Beasts of Field and Wood, page 25; Squirrels and Other Fur Bearers, chapter 7; Fox Ways in Ways of Wood Folk; The Springfield Fox in Wild Animals I Have Known; Familiar Wild Animals; Familiar Life in Field and Forest, page 213; American Animals, page 264; Nights with Uncle Remus.

A pet red fox.
Photo by Fred S. Charles.

DOGS

Teacher's Story

NOT only to-day but in ancient days, before the dawn of history, the dog was the companion of man. Whether the wild species from whence he sprang, was wolf or jackal or some other similar animal, we do not know, but we do know that many types of dogs have been tamed independently by savages, in the region where their untamed relatives run wild. As the whelps of wolves, jackals and foxes are all easily tamed, and are most interesting little creatures, we can understand how they became companions to the children of the savage and barbarous peoples who hunted them.

In the earliest records of cave dwellers, in the picture writing of the ancient Egyptians and of other ancient peoples, we find record of the presence and value of the dog. But man, in historical times, has been able to evolve breeds that vary more in form than do the wild species of the present. There are 200 distinct breeds of dogs known to-day, and many of these have been bred for special purposes. The paleontologists, moreover, assure us that there has been a decided advance in the size and quality of the dog's brain since the days of his savagery; thus, he has been the companion of man's civilization also. It is not, therefore, to be wondered at that the dog is now the most companionable, and has the most human qualities and intelligence of all our domesticated animals.

Dogs run down their prey; it is a necessity, therefore, that they be equipped with legs that are long, strong and muscular. The cat, which jumps for her prey, has much more delicate legs but has powerful hips to enable her to leap. The dog's feet are much more heavily padded than those of the cat, because in running, he must not stop to save his feet. Hounds often return from a chase with bleeding feet, despite the heavy pads, but the wounds are usually cuts between the toes. The claws are heavy and are not retractile; thus, they afford a protection to the feet when running, and they are also used for digging out game which burrows into the ground. They are not used for grasping prey like those of the cat and are used only incidentally in fighting, while the cat's claws are the most important weapons in her armory. It is an interesting fact that Newfoundland dogs, which are such famous swimmers, have their toes somewhat webbed.

Greyhound.

The dog's body is long, lean, and very muscular, a fat dog being usually pampered and old. The coat is of hair and is not of fine fur like that of the cat. It is of interest to note that the Newfoundland dog has an inner coat of fine hair comparable to that of the mink or muskrat. When a dog is running, his body is extended to its fullest length; in fact, it seems to "lie flat," the outstretched legs heightening the effect of extreme muscular effort of forward movement. A dog is master of several gaits; he can run, walk, trot, bound and crawl.

The iris of the dog's eye is usually of a beautiful brown, although this varies with breeds; in puppies, the iris is usually blue. The pupil is round like our own; and dogs cannot see well in the dark like the cat, but in daylight they have keen sight. The nose is so much more efficient than the eyes, that it is on the sense of smell the dog depends for following his prey and for recognizing friend and foe. The damp, soft skin that covers the nose, has in its dampness the conditions for carrying the scent to the wide nostrils; these are situated at the most forward part of the face, and thus may be lifted in any direction to receive the marvelous impressions, so completely beyond our comprehension. Think of being able to scent the track of a fox made several hours previously. Not only to scent it, but to follow by scent for many miles without ever having a glimpse of the fleeing foe! In fact, while running, the dog's attention seems to be focused entirely upon the sense of smell, for I have seen hounds pass within a few rods to the windward of the fox they were chasing, without observing him at all. When the nose of any of the moist-nosed beasts, such as cattle and dogs, becomes dry it is a sign of illness.

Bird dog.

A light fall of damp snow gives the dog the best conditions for following a track by scent and a hound, when on the trail, will run until exhausted. There are many authentic observations which show that hounds have followed a fox for twenty-four hours without food, and probably with little rest.

The dog's weapons for battle, like those of the wolf, are his tushes: with these, he holds and tears his prey; with them, he seizes the woodchuck or other small animal through the back and shakes its life out. In fighting a larger animal, the dog leaps against it and often incidentally tears its flesh with his strong claws; but he does not strike a blow with his foot like the cat, nor can he hold his quarry with it.

Dog's teeth are especially fitted for their work. The incisors are small and sharp; the canine teeth or tushes are very long, but there are bare spaces on the jaws so that they are able to cross past each other; the molar teeth are not fitted for grinding, like the teeth of a cow, but are especially fitted for cutting, as may be noted if we watch the way a dog gnaws bones, first gnawing with the back teeth on one side and then on the other. In fact, a dog does not seem to need to chew anything, but simply needs to cut his meat in small enough pieces so that he can gulp them down without chewing. His powers of digesting unchewed food are something that the hustling American may well envy.

Bulldog.

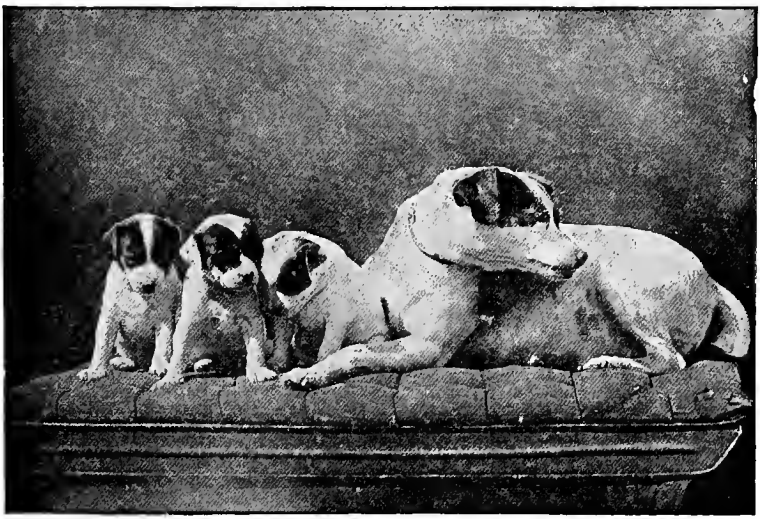
Of all domestic animals, the dog is most humanly understandable in expressing emotions. If delighted, he leaps about giving ecstatic little barks and squeals, his tail in the air and his eyes full of happy an-

"Mateo", a St. Bernard of long pedigree.

ticipation. If he wishes to be friendly, he looks at us interestedly, comes over to smell of us in order to assure himself whether he has ever met us before, and then wags his tail as a sign of good faith. If he wishes to show affection, he leaps upon us and licks our face or hands with his soft, deft tongue and follows us jealously. When he stands at attention, he holds his tail stiff in the air, and looks up with one ear lifted as if to say, "Well, what's doing?" When angry, he growls and shows his teeth and the tail is held rigidly out behind, as if to convince us that it is really a continuation of his backbone. When afraid, he whines and lies flat upon his belly, often looking beseechingly up toward his master as if begging not to be punished; or he crawls away out of sight. When ashamed, he drops his tail between his legs and with drooping head and sidewise glance slinks away. When excited, he barks and every bark expresses high nervous tension.

Almost all dogs that chase their prey, bark when so doing, which would seem at first sight to be a foolish thing to do, in that it reveals their whereabouts to their victims and also adds an incentive to flight. But it must be borne in mind that dogs are descended from wolves, which naturally hunt in packs and do not stalk their prey. The baying of the hound is a most common example of the habit, and as we listen we can understand how, by following this sound, the pack is kept together. Almost all breeds of dogs have an acute sense of hearing. When a dog bays at the moon or howls when he hears music, it is simply a reversion to the wild habit of howling to call together the pack or in answer "to the music of the pack." It is interesting that our music, which is the flower of our civilization, should awaken the sleeping ancestral traits in the canine breast. But perhaps that, too, is why we respond to music, because it awakens in us the strong, primitive emotions, and for the time, enables us to free ourselves from all conventional shackles and trammels.

Bloodhound.



Fox terrier and pups.

LESSON LXIII

DOGS

Leading thought—The dog is a domesticated descendant of wolf-like animals and has retained certain of the habits and characteristics of his ancestors.

Method—For the observation lesson it would be well to have at hand, a well-disposed dog which would not object to being handled; a collie or a hound would be preferable. Many of the questions should be given to the pupils to answer from observations at home, and the lesson should be built upon the experience of the pupils with dogs.

Observations—1. Why are the legs of the dog long and strong in proportion to the body compared with those of the cat?

2. Compare the feet of the cat with those of the dog and note which has the heavier pads. Why is this of use to each?

3. Which has the stronger and heavier claws, the dog or the cat? Can the dog retract his claws so that they are not visible, as does the cat? Of what use is this arrangement to the dog? Are the front feet just like the hind feet? How many toe impressions show in the track of the dog?

4. What is the general characteristic of the body of the dog? Is it soft like that of the cat, or lean and muscular? What is the difference between the hair covering of the dog and cat? What is the attitude of the dog when running fast? How many kinds of gaits has he?

5. In general, how do the eyes of the dog differ from those of the cat? Does he rely as much upon his eyes for finding his prey as does the cat? Can a dog see in the dark? What is the color of the dog's eyes?

6. Study the ear of the dog; is it covered? Is this outer ear movable, is it a flap, or is it cornucopia shaped? How is this flap used when the dog is listening? Roll a sheet of paper into a flaring tube and place the

small end upon your own ear, and note if it helps you to hear better the sounds in the direction toward which the tube opens? Note how the hound lifts his long earlaps, so as to make a tube for conveying sounds to his inner ear. Do you think that dogs can hear well?

"Klondike Jack".
The dog that pulled four hundred fifty pounds five hundred miles through the White Horse Pass in the winter of the first gold excitement.

7. What is the position of the nose in the dog's face? Of what use is this? Describe the nostrils; are they placed on the foremost point of the face? What is the condition of the skin that surrounds them? How does this condition of the nose aid the dog? What other animals have it? Does the dog recognize his friends or become acquainted with strangers by means of his sight or of his powers of smelling?

8. How long after a fox or rabbit has passed can a hound follow the track? Does he follow it by sight or by smell? What are the conditions most favorable for retaining the scent? The most unfavorable? How long will a hound follow a fox trail without stopping for rest or food? Do you think the dog is your superior in ability to smell?

9. How does a dog seize and kill his prey? How does he use his feet and claws when fighting? What are his especially strong weapons? Describe a dog's teeth and explain the reason for the bare spaces on the jaw next to the tushes. Does the dog use his tushes when chewing? What teeth does he use when gnawing a bone? Make a diagram of the arrangement of the dog's teeth.

10. How by action, voice, and especially by the movement of the tail does the dog express the following emotions: Delight, friendliness, affection, attention, anger, fear, shame, excitement? How does he act when chasing his prey? Why do wolves and dogs bark when following the trail? Do you think of a reason why dogs often howl at night or when listening to music? What should we feed to our pet dogs? What should we do to make them comfortable in other ways?

11. Tell or write a story of some dog of which you know by experience or hearsay.

In pleasant mood.
A collie.

Of what use was the dog to the pioneer? How are dogs used in the Arctic regions? In Holland?

12. How many breeds of dogs do you know? Describe characters of such as follows: The length of the legs as compared with the body; the general shape of the body, head, ears, nose; color and character of hair on head, body and tail.

13. Find if you can the reasons which have led to the developing of the following breeds: Newfoundland, St. Bernard, mastiffs hounds, collies, spaniels, setters, pointers, bulldogs, terriers, and pugs.

Supplementary reading—"Stories of Brave Dogs" from *St. Nicholas*, the Century Co.; the following three stories from Thompson-Seton: "Chink" in Lives of the Hunted, "Snap" in Animal Heroes, "Wully" in Wild Animals I Have Known; Bob, Son of Battle; Mack, His Book, by Florence Leigh; Rab and his Friends; The Dog of Flanders; "Red Dog" in Kipling's Jungle Stories; Animals of the World, Knight and Jenks, p. 80; Life of Animals, Ingersoll, p. 187.

Fox hunting, in the Genesee Valley, N. Y.

An aristocrat.

THE CAT

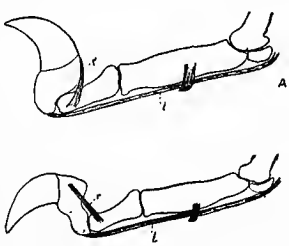
Teacher's Story

OF all people, the writer should regard the cat sympathetically, for when she was a baby of five months she was adopted by a cat. My self-elected foster-mother was Jenny, a handsome black and white cat, which at that time lost her first litter of kittens, through the attack of a savage cat from the woods. She was as Rachel crying for her children, when she seemed suddenly to comprehend that I, although larger than she, was an infant. She haunted my cradle, trying to give me milk from her own breasts; and later she brought half-killed mice and placed them enticingly in my cradle, coaxing me to play with them, a performance which pleased me much more than it did my real mother. Jenny always came to comfort me when I cried, rubbing against me, purring loudly, and licking me with her tongue in a way to drive mad the modern mother, wise as to the sources of children's internal parasites. This maternal attitude toward me lasted as long as Jenny lived, which was until I was nine years old. Never during those years did I lift my voice in wailing, that she did not come to comfort me; and even to-day I can remember how great that comfort was, especially when my naughtiness was the cause of my weeping, and when, therefore, I felt that the whole world, except Jenny, was against me.

Jenny was a cat of remarkable intelligence and was very obedient and useful. Coming down the kitchen stairs one day, she played with the latch and someone hearing her, opened the door. She did this several times, when one day she chanced to push down the latch, and thus opened the door herself. After that, she always opened it herself. A little later, she tried the trick on other doors, and soon succeeded in opening all the latched doors in the house, by thrusting one front leg through the handle, and thus supporting her weight and pressing down with the foot of the other on the thumb-piece of the latch. I remember, guests were greatly astonished to see her coming thus swinging into the sitting-room. Later she tried the latches from the other side, jumping up and trying to lift the hook; but now, her weight was thrown against the wrong side of the door for opening, and she soon ceased this futile waste of energy; but for several years, she let herself into all the rooms in this clever manner, and taught a few of her bright kittens to do the same.

A pet cat enjoys long conversations with favored members of the household. She will sit in front of her mistress and mew, with every appearance of answering the questions addressed her; and since the cat and the mistress each knows her own part of the conversation, it is perhaps more typical of society chatter than we might like to confess. Of our language, the cat learns to understand the call to food, its own name, "scat," and "No, No," probably inferring the meaning of the latter from the tone of voice. On the other hand, we understand when it asks to go out, and its polite recognition to the one who opens the door. I knew one cat which invariably thanked us when we let him in as well as out. When the cat is hungry, it mews pleadingly; when happy in front of the fire, it looks at us sleepily out of half-closed eyes and gives a short mew expressive of affection and content; or it purrs, a noise which we do not know how to imitate and which expresses perfectly the happiness of intimate companionship. When frightened the cat yowls, and when hurt squalls shrilly; when fighting, it is like a savage warrior in that it howls a war-song in blood-curdling strains, punctuated with a spitting expressive of fear and contempt; and unfortunately, its love song is scarcely less agonizing to the listener. The cat's whole body enters into the expression of its emotions. When feeling affectionate toward its mistress, it rubs against her gown, with tail erect, and vibrating with a purr which seems fundamental. When angry, it lays its ears back and lashes its tail back and forth, the latter being a sign of excitement; when frightened, its hair stands on end, especially the hair of the tail, making that expressive appendage twice its natural size; when caught in disobedience, the cat lets its tail droop, and when running lifts it in a curve.

While we feed cats milk and scraps from our own table, they have never become entirely civilized in their tastes. They always catch mice and other small animals and prove pestiferous in destroying birds. Jenny was wont to bring her quarry, as an offering, to the front steps of our home every night; one morning we found seven mice, a cotton-tail rabbit and two snakes, which represented her night's catch. The cat never chases its prey like the dog. It discovers the haunts of its victims,



Bones and ligaments of cat's claw.
A Claw up. B Claw thrust out.

and then lies in ambush, flattened out as still as a statue and all its feet beneath it, ready to make the spring. The weight of the body is a factor which enters in the blow with which the cat strikes down its victim, and thus stuns and which it later kills by gripping the throat with the strong tushes. She carries her victims as she does her kittens, by the back.

The cat's legs are not long compared with the body, and it runs with a leaping gallop; the upper legs are armed with powerful muscles. It walks on the padded toes, five on the front feet and four of the hind feet. The cat needs its claws to be sharp and hooked, in order to seize and hold its prey, so they are kept safely sheathed when not thus used. If the claws struck the earth during walking, as do the dog's, they would soon become dulled. When sharpening its claws it reaches high up against a tree or post, and strikes them into the wood with a downward scratch; this act is probably more for exercising the muscles which control the claws than for sharpening them.

The cat's track is in a single line as if it had only two feet, one set directly ahead of the other. It accomplishes this by setting its hind feet exactly in the tracks made by the front feet. The cat can easily leap upward, landing on a window-sill five feet from the ground. The jump is made with the hind legs and the alighting is done silently on the front feet.

Cats' eyes are fitted for seeing in the dark; in the daytime the pupil is simply a narrow, up and down slit; under excitement, and at night, the pupil covers almost the entire eye. At the back of the eye is a reflecting surface, which catches such dim light as there is, and by reflecting it enables the cat to use it twice. It is this reflected light, which gives the peculiar green glare to the eyes of all the cats when seen in the dark. Some night-flying moths have a like arrangement for utilizing the light, and their eyes glow like living coals. Of course, since the cat is a night hunter, this power of multiplying the rays of light is of great use. The iris of the eye is usually yellow, but in kittens it may be blue or green.

"Folks are so tiresome."

The cat's teeth are pecularily fitted for its needs. The six doll-like incisors of the upper and lower jaw are merely for scraping meat from bones. The two great tushes, or canines, on each jaw, with a bare place behind so that they pass each other freely, are sharp and hooked, and are for seizing and carrying prey. The cat is able to open its mouth as wide as a right angle, in order to better hold and carry prey. The back teeth, or molars, are four on each side in the upper jaw and three, below. They are sharp-edged wedges made for cutting meat fine enough, so that it may be swallowed.

The tongue is covered with sharp papillæ directed backwards, also used for rasping juices from meat. The cat's nose is moist, and her sense of smell very keen, as is also her sense of hearing. The ears rise like two hollow half-cones on either

side of the head and are filled with sensitive hairs; they ordinarily open forward, but are capable of movement. The cat's whiskers consist of from twenty-five to thirty long hairs set in four lines, above and at the sides of the mouth; they are connected with sensitive nerves and are therefore true feelers. The cat's fur is very fine and thick, and is also sensitive; as can readily be proved, by trying to stroke it the wrong way. While the wild cats have gray or tawny fur, variously mottled or shaded, the more striking colors we see in the domestic cats are the result of man's breeding.

Cats are very cleanly in their habits. Puss always washes her face directly after eating, using one paw for a wash-cloth and licking it clean after she rubs her face. She cleans her fur with her rough tongue and also by biting; and she promptly buries objectionable matter. The mother cat is very attentive to the cleanliness of her kittens, licking them clean from nose tip to tail tip. The ways of the mother cat with her kittens do much to sustain the assertions of Mr. Seton and Mr. Long that young animals are trained and educated by their parents. The cat brings half-dazed mice to her kittens, that they may learn to follow and catch them with their own little claws. When she punishes them, she cuffs the ears by holding one side of the kitten's head firm with the claws of one foot, while she lays on the blows with the other. She carries her kittens by the nape of the neck, never hurting them. She takes them into the field when they are old enough, and shows them the haunts of mice, and does many things for their education and welfare. The kittens meantime train themselves to agility and dexterity, by playing rough and tumble with each other, and by chasing every small moving object, even to their own tails.

"Interested!"

The cat loves warmth and finds her place beneath the stove or at the hearthside. She likes some people, and dislikes others, for no reason we can detect. She can be educated to be friendly with dogs and with birds. In feeding her, we should give her plenty of sweet milk, some cooked meat and fish of which she is very fond; and we should keep a bundle of catnip to make her happy, for even the larger cats of the wilderness seem to have a passionate liking for this herb. The cat laps milk with her rough tongue, and when eating meat, she turns the head this way and that, to cut the tough muscle with her back teeth.

Cats Should be Trained to Leave Birds Alone

Every owner of a cat owes it to the world to train puss to leave birds alone. If this training is begun during kittenhood, by switching the culprit every time it even looks at a bird, it will soon learn to leave them severely alone. I have tried this many times, and I know it is efficacious, if the cat is intelligent. We have never had a cat whose early training we controlled, that could ever be induced to even watch birds. If a cat is not thus trained as a kitten, it is likely to be always treacherous in this respect. But in case any one has a valuable cat which is given to catching birds, I strongly advise the following treatment which has been proved practicable by a friend of mine. When a cat has made the catch, take the bird away and sprinkle it with red pepper, and then give it back. One such treatment as this resulted in making one cat, which was an inveterate bird hunter, run and hide every time he saw a bird thereafter. Any persons taking cats with them to their summer homes, and abandoning them there to prey upon the birds of the vicinity, and to become poor, half-starved, wild creatures, ought to be arrested and fined. It is not only cruelty to the cats, but it is positive injury and damage to the community, because of the slaughter of beneficial birds which it entails.

This cat has been trained to be friendly with birds.

LESSON LXIV

The Cat

Leading thought—The cat was made a domestic animal before man wrote histories. It gets prey by springing from ambush and is fitted by form of body and teeth to do this. It naturally hunts at night and has eyes fitted to see in the dark.

Method—This lesson may be used in primary grades by asking a few questions at a time and allowing the children to make their observations on their own kittens at home, or a kitten may be brought to school for this purpose. The upper grade work consists of reading and retelling or writing exciting stories of the great, wild, savage cats, like the tiger, lion, leopard, lynx and panther.

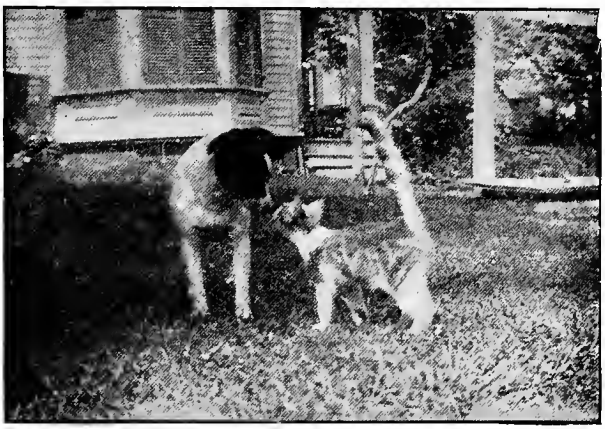
Observations—1. How much of Pussy's language do you understand? What does she say when she wishes you to open the door for her? How does she ask for something to eat? What does she say when she feels like conversing with you? How does she cry when hurt? When frightened? What noise does she make when fighting? When calling other cats? What are her feelings when she purrs? When she spits? How many things which you say does she understand?

2. How else than by voice does she express affection, pleasure and anger? When she carries her tail straight up in the air is she in a pleasant mood? When her tail "bristles up" how does she feel? What is it a sign of, when she lashes her tail back and forth?

3. What do you feed to cats? What do they catch for themselves? What do the cats that are wild live upon? How does the cat help us? How does she injure us?

4. How does a cat catch her prey? Does she track mice by the scent? Does she catch them by running after them as a dog does? Describe how she lies in ambush. How does she hold the mouse as she pounces upon it? How does she carry it home to her kittens?

5. Study the cat's paws to see how she holds her prey. Where are the sharp claws? Are they always in sight like a dog's? Does she touch them to the ground when she walks? Which walks the more silently,



Amicable advances.

a dog or a cat? Why? Describe the cat's foot, including the toe-pads. Are there as many toes on the hind feet as on the front feet? What kind of a track does the cat make in the snow? How does she set her feet to make such a track? How does she sharpen her claws? How does she use her claws for climbing? How far have you ever seen a cat jump? Does she use her front or her hind feet in making the jump? On which feet does she alight? Does she make much noise when she alights?

6. What is there peculiar about a cat's eyes? What is their color? What is the color of kittens' eyes? What is the shape of the pupil in daylight? In the dark? Describe the inner lid which comes from the corner of the eye.

7. How many teeth has Puss? What is the use of the long tushes? Why is there a bare space behind these? What does she use her little front teeth for? Does she use her back teeth for chewing or for cutting meat?

8. How many whiskers has she? How long are they? What is their use? Do you think that puss has a keen sense of smell? Why do

you think so? Do you think she has a keen sense of hearing? How do the shape and position of the ears help in listening? In what position are the ears when puss is angry?

9. How many colors do you find in our domestic cats. What is the color of wild cats? Why would it not be beneficial to the wild-cat to have as striking colors as our tame cats? Compare the fur of the cat with the hair of the dog. How do they differ? If a cat chased her prey like the dog do you think her fur would be a too warm covering?

10. Describe how the cat washes her face. How does she clean her fur? How does her rough tongue help in this? How does the mother cat wash her kittens?

11. How does a little kitten look when a day or two old? How long before its eyes open? How does the cat carry her kittens? How does a kitten act when it is being carried? How does the mother cat punish her kittens? How does she teach them to catch mice? How do kittens play? How does the exercise they get in playing fit them to become hunters?

12. How should cats be trained not to touch birds? When must this training begin? Why should a person be punished for injury to the public who takes cats to summer cottages and leaves them there to run wild?

13. Where in the room does puss best like to lie? How does she sun herself? What herb does she like best? Does she like some people and not others? What strange companions have you known a cat to have? What is the cat's chief enemy? How should we care for and make her comfortable?

14. Write or tell stories on the following subjects: (1) The things which my pet cat does; (2) The Wild Cat; (3) The Lion; (4) The Tiger; (5) The Leopard; (6) The Panther and the Mountain Lion; (7) The Lynx; (8) The History of Domestic Cats; (9) The Different Races of Cats, describing the Manx, the Persian and the Angora Cats.

Supplementary reading—The Life of Animals, Ingersoll; American Animals, Stone and Cram; Our Domestic Animals, Burkett; The Fireside Sphinx, Repplier; Concerning Cats, Winslow; The following animal stories from *St. Nicholas* Magazine: Cat Stories, Lion and Tiger Stories, Panther Stories.

Photo by Verne Morton

Saanen goats in Switzerland.
Peer, Twenty-first Annual Report Bureau of Animal Industry, U. S. Department of Agriculture.

THE GOAT

Teacher's Story

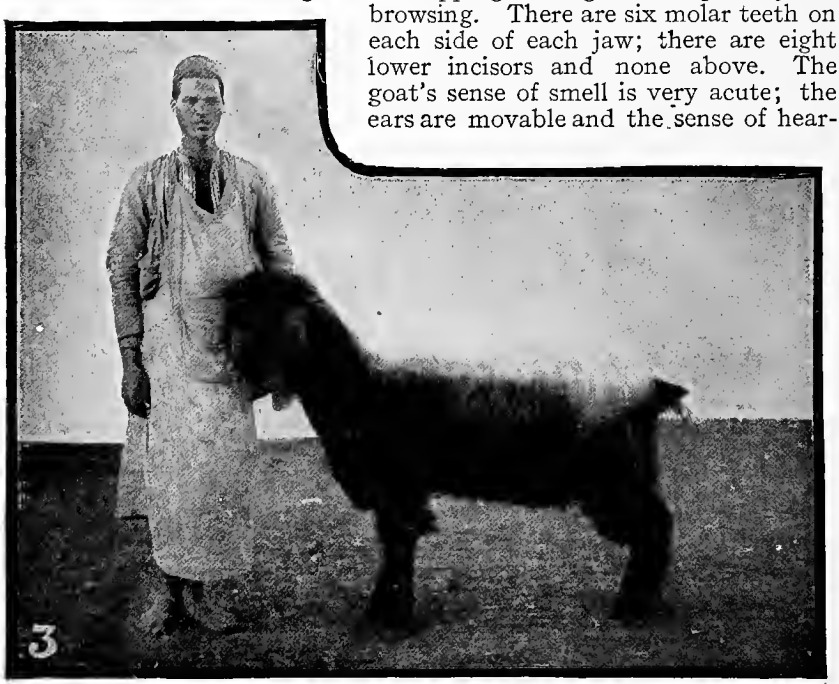
Little do we in America realize the close companionship that has existed in older countries, from time immemorial, between goats and people. This association began when man was a nomad, and took with him in his wanderings, his flocks, of which goats formed the larger part. He then drank their milk, ate their flesh, wove their hair into raiment, or made cloth of their pelts, and used their skins for water bags. Among peoples of the East all these uses continue to the present day. In the streets of Cairo, old Arabs may be seen with goat skins filled with water upon their backs; and in any city of Western Asia or Southern Europe, flocks of goats are driven along the streets to be milked in sight of the consumer.

In order to understand the goat's peculiarities of form and habit, we should consider it as a wild animal, living upon the mountain heights amid rocks and snow and scant vegetation. It is marvelously sure-footed, and when on its native mountains, it can climb the sharpest crags and leap chasms. This peculiarity has been seized upon by showmen who often exhibit goats which walk on the tight rope with ease, and even turn themselves upon it without falling. The instinct for climbing still lingers in the domestic breeds, and in the country the goat may be seen on top of stone piles or other objects, while in city suburbs, its form may be discerned on the roofs of shanties and stables.

It is a common saying that a goat will eat anything, and much sport is made of this peculiarity. This fact has more meaning for us when we realize that wild goats live in high altitudes, where there is little plant life, and are therefore, obliged to find sustenance on lichens, moss and such scant vegetation as they can find.

The goat is closely allied to the sheep, differing from it in only a few particulars; its horns rise from the forehead curving over backward and do not form a spiral like those of the ram; its covering is usually of hair, and the male has a beard from which we get the name goatee; the goat has no gland between the toes, and it does have a rank and disagreeable odor. In a wild state, it usually lives a little higher up the mountains than do the sheep, and it is a far more intelligent animal. Mary Austin says: "Goats lead naturally by reason of a quicker instinct, forage more freely and can find water on their own account, and give voice in case of alarm. Goat leaders exhibit jealousy of their rights to be first over the stepping-stones or to walk the teetering log bridges at the roaring creeks." On the great plains, it is a common usage to place a few goats in a flock of sheep, because of the greater sagacity of these animals as leaders, and also as defenders in case of attack.

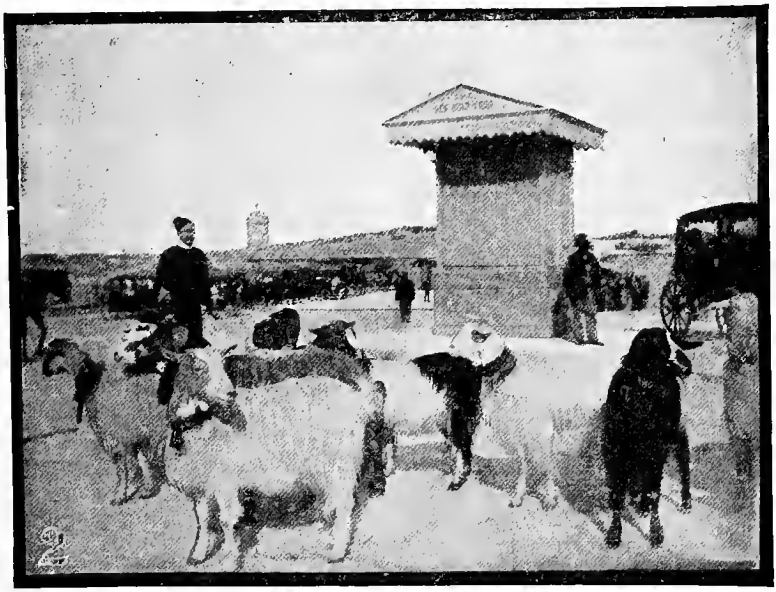
Goats' teeth are arranged for cropping herbage and especially for browsing. There are six molar teeth on each side of each jaw; there are eight lower incisors and none above. The goat's sense of smell is very acute; the ears are movable and the sense of hearing is keen; the eyes are full and very intelligent; the horns are somewhat flattened and angular and often knobbed somewhat in front, and curve backward above the neck; they are, however, very efficient as weapons of defence. The legs are strong, though not large, and are well fitted for leaping and running. The feet have two hoofs, that is, the animal walks upon two toe-nails. There are two smaller toes behind



Zaraibi milch goats of Egypt.
Thompson. Twenty-first Annual Report Bureau of Animal Industry, U. S. Department of Agriculture.

and above the hoofs. The goat can run with great rapidity. The tail of the goat is short like that of the deer, and does not need to be amputated like that of the sheep. Although the normal covering of the goat is hair, there are some species which have a more or less woolly coat. When angry the goat shakes its head, and defends itself by butting with the head, also by striking with the horns, which are very sharp. Goats are very tractable and make affectionate pets when treated with kindness; they display far more affection for their owner than do sheep.

Our famous Rocky Mountain goat, although it belongs rather to the antelope family, is a large animal, and is the special prize of the hunter; however, it still holds its own in the high mountains of the Rocky and

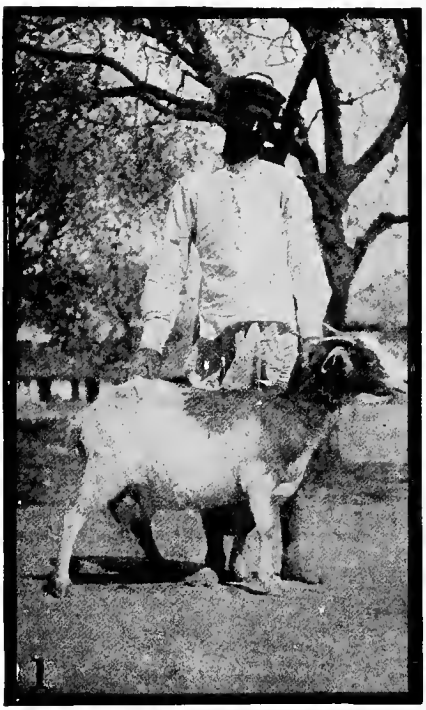


Milch goats in Malta.
Thompson. Twenty-first Annual Report Bureau of Animal Industry, Department of Agriculture.

Cascade Ranges. Both sexes have slender black horns, white hair, and black feet, eyes and nose. Owen Wister says of this animal: "He is white, all white, and shaggy, and twice as large as any goat you ever saw. His white hair hangs long all over him like a Spitz dog's or an Angora cat's; and against its shaggy white mass the blackness of his hoofs and horns, and nose looks particularly black. His legs are thick, his neck is thick, everything about him is thick, save only his thin black horns. They're generally about six (often more than nine) inches long, they spread very slightly, and they curve slightly backward. At their base they are a little rough, but as they rise they become cylindrically smooth and taper to an ugly point. His hoofs are heavy, broad and blunt. The female is lighter than the male, and with horns more slender, a trifle. And (to return to the question of diet) we visited the pasture where the herd (of thirty-five) had been, and found no signs of grass growing or grass eaten; there was no grass on that mountain. The only edible substance

was a moss, tufted, stiff and dry to the touch. I also learned that the goat is safe from predatory animals. With his impenetrable hide and his disemboweling horns he is left by the wolves and mountain lions respectfully alone." (See American Animals, p. 57; Camp Fires of a Naturalist, chapters VIII and XIII).

Milch Goats—Many breeds of these have been developed, and the highest type is, perhaps, found in Switzerland. The Swiss farmers have found the goat particularly adapted to their high mountains and have used it extensively; thus, goats developed in the Saane and Toggenburg valleys have a world-wide reputation. Above these valleys the high mountains are covered with perpetual snow, and winter sets in about November 1st, lasting until the last of May. The goats are kept with the cows in barns and fed upon hay; but as soon as the snow is gone from the valleys and the lower foot-hills, the cattle and goats are sent with the herders and boy assistants, to the grazing grounds. A bell is put upon the cow that leads the herd so as to keep it together and the boys, in their gay peasant dresses, are as happy as the playful calves and goats to get out in the spring sunshine. The herds follow the receding snows up the mountains until about midsummer, when they reach the high places of scanty vegetation; then they start on the downward journey, returning to the home and stables about November 1st. The milk from goats is mixed with that from cows to make cheese, and this cheese has a wide reputation; some of the varieties are: Roquefort, Schweitzer and Altenburger. Although the cheese is excellent, the butter made from goat's milk is quite inferior to that made from the cow's. The milk, when the animals are well taken care of, is exceedingly nourishing; it is thought to be the best milk in the world for children. Usually, the trouble with goat's milk is, that the animals are not kept clean nor is care taken in milking. Germany has produced many distinct and excellent breeds of milch goats; the Island of Malta, Spain, England, Ireland, Egypt and Nubia have each developed noted breeds. Of all these, the Nubias give the most milk, sometimes yielding from four to six quarts per day, while an ordinary goat is considered fairly good if it yields two quarts per day.



Poona (India) goat.

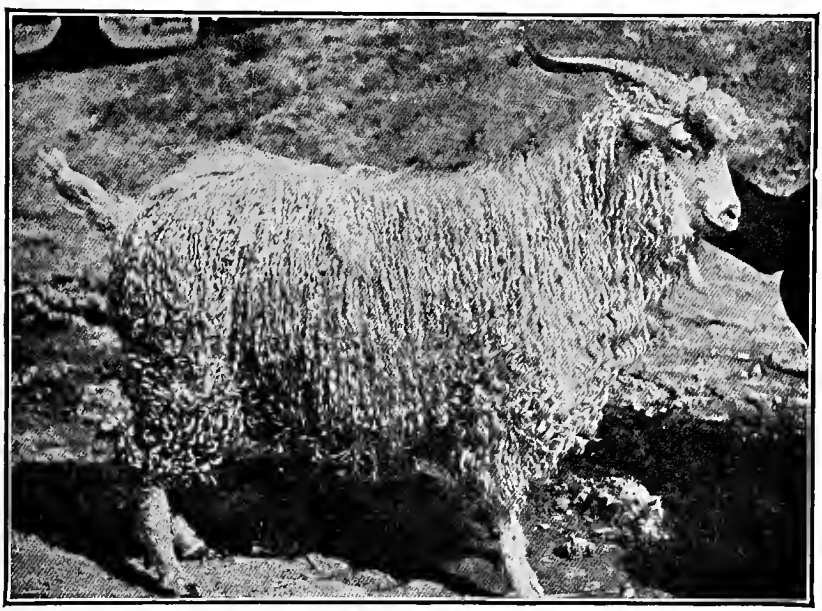
Thompson. Twenty-first Annual Report Bureau of Animal Industry, U. S. Department of Agriculture.

The Mohair Goats—There are two noted breeds of goats whose hair is used extensively for weaving into fabrics; one of these is the Cashmere and the other the Angora. The Cashmere goat has long, straight, silky hair for an outside coat and has a winter under-coat of very delicate wool. There are not more than two or three ounces of this wool upon one goat, and this is made into the famous Cashmere shawls; ten goats furnish barely enough of this wool for one shawl. The Cashmere goats are grown most largely in Thibet, and the wool is shipped from the high tableland to the Valley of Cashmere, and is made into shawls. It requires the work of several people for a year to produce one of these famous shawls.

The Angora goat has a long, silky and very curly fleece. These goats were first discovered in Angora, a city of Asia Minor south of the Black Sea, and some 200 miles southeast from Constantinople. The Angora goat is a beautiful and delicate animal, and furnishes most of the mohair, which is made into the cloths known as mohair, alpaca, camel's hair and many other fabrics. The Angora goat has been introduced into America, in California, Texas, Arizona, and to some extent in the Middle West. It promises to be a very profitable industry. (See Farmers' Bulletin No. 137, "The Angora Goat," United States Department of Agriculture.)

The skins of goats are used extensively; morocco, gloves and many other articles are made from them. In the Orient, the skin of the goat is used as a bag in which to carry water and wine.

References—American Animals, p. 55; Neighbors with Claws and Hoofs, p. 190; Familiar Animals, pp. 169 and 183; Camp Fires of a Naturalist, chapters VIII and XIII; Lives of Animals.



Angora goat.

Thompson, Twenty-first Annual Report Bureau of Animal Industry
U. S. Department of Agriculture.

LESSON LXV

The Goat

Leading thought—Goats are among our most interesting domesticated animals, and their history is closely interwoven with the history of the development of civilization. In Europe, their milk is made into cheese that has a world-wide fame; and from the hair of some of the species, beautiful fabrics are woven. The goat is naturally an animal of the high mountains.

Method—A span of goats harnessed to a cart is second only to ponies, in a child's estimation; therefore, the beginning of this lesson may well be a span of goats thus employed. The lesson should not be given unless the pupils have an opportunity for making direct observations on the animal's appearance and habits. There should be some oral and written work in English done with this lesson. Following are topics for such work: "The Milch Goat of Switzerland," "How Cashmere Shawls are Made," "The Angora Goat," "The Chamois."

Observations—1. Do you think that goats like to climb to high points? Are they fitted to climb steep, inaccessible places? Can they jump off steep places in safety? How does it happen the goat is sure-footed? How do its legs and feet compare with those of the sheep?

2. What does the goat eat? Where does it find its natural food on mountains? How are the teeth arranged for cutting its food? Does a goat chew its cud like a cow?

3. What is the covering of the goat? Describe a billy-goat's beard. Do you suppose this is for ornament? For what is goat's hair used?

4. Do you think the goat has a keen sense of sight, of hearing and of smell? Why? Why did it need to be alert and keen when it lived wild upon the mountains? Do you think the goat is intelligent? Give instances of this?

5. Describe the horns. Do they differ from the horns of the sheep? How does a goat fight? Does he strike head on, like the sheep, or sidewise? How does he show anger?

6. What noises does a goat make? Do you understand what they mean?

7. Describe the goat, its looks and actions. Is the goat's tail short at first or does it have to be cut off like the lamb's tail? Where and how is goat's milk used? What kinds of cheese are made from it? For what is its skin used? Is its flesh ever eaten?

Everyone knows the gayety of young kids, which prompts them to cut the most amusing and burlesque capers. The goat is naturally capricious and inquisitive, and one might say crazy for every species of adventure. It positively delights in perilous ascensions. At times it will rear and threaten you with its head and horns, apparently, with the worst intentions, whereas it is usually an invitation to play. The bucks, however, fight violently with each other; they seem to have no consciousness of the most terrible blows. The ewes themselves are not exempt from this vice.

They know very well whether or not they have deserved punishment. Drive them out of the garden, where they are forbidden to go, with a whip and they will flee without uttering a sound; but strike them without just cause and they will send forth lamentable cries.

Charles William Burkett in "Our Domestic Animals."

A Sicilian shepherd.
Photo by J. H. Comstock.

THE SHEEP

Teacher's Story

"The earliest important achievement of ovine intelligence is to know whether its own notion or another's is most worth while, and if the other's, which one? Individual sheep have certain qualities, instincts, competences, but in the man-herded flocks these are superseded by something which I shall call the flock mind, though I cannot say very well what it is, except that it is less than the sum of all their intelligences. This is why there have never been any notable changes in the management of flocks since the first herder girt himself with a wallet of sheep-skin and went out of his cave-dwelling to the pastures."—"The Flock," by MARY AUSTIN.

Both sheep and goats are at home on mountains, and sheep especially, thrive best in cool, dry locations. As wild animals, they were creatures of the mountain crag and chasm, although they frequented more open places than the mountain goats, and their wool was developed to protect them from the bitter cold of high altitudes. They naturally gathered in flocks, and sentinels were set to give warning of the approach of danger; as soon as the signal came, they made their escape, not in the straight away race like the deer, but in following the leader over rock, ledge and precipice to mountain fastnesses where wolf nor bear could follow. Thus, the instinct of following the leader blindly, came to be the salvation of the individual sheep.

The teeth of the sheep are like those of the goat, eight incisors below and none on the upper row, and six grinding teeth at the back of each side

of each jaw. This arrangement of teeth on the small, delicate, pointed jaws enables the sheep to crop herbage where cattle would starve; it can cut the small grass off at its roots, and for this reason, where vast herds of sheep range, they leave a desert behind them. This fact brought about a bitter feud between the cattle and sheep men in the far West. In forests, flocks of sheep completely kill all underbrush, and now they are not permitted to run in government reserves.

The sheep's legs are short and delicate below the ankle. The upper portion is greatly developed to help the animal in leaping, a peculiarity to which we owe the "leg of lamb" as a table delicacy. The hoof is cloven, that is, the sheep walks upon two toes; it has two smaller toes above and behind these. There is a little gland between the front toes which secretes

A sheep of pedigree, Shropshire ram.

an oily substance, which perhaps serves in preventing the hoof from becoming too dry. The ears are large and are moved to catch better the direction of sound. The eyes are peculiar; in the sunlight the pupil is a mere slit, while the iris is yellow or brownish, but in the dark, even of the stable, the pupils enlarge, almost covering the eye. The ewes either lack horns or have small ones, but the horns of wild rams are large, placed at the side of the head and curled outward in a spiral. These horns are perhaps not so much for fighting the enemy as for rival rams. The ram can strike a hard blow with head and horns, coming at the foe head on, while the goat always strikes sidewise. So fierce is the blow of the angry sheep, that an ancient instrument of war was fashioned like a ram's head and used to knock down walls, and was called a battering ram. A sheep shows anger by stamping the ground with the front feet. The habit of rumination enables the sheep to feed in a flock and then retire to some place to rest and chew the cud, a performance peculiarly funny in the sheep.

Sheep under attack and danger are silent; ordinarily they keep up a constant, gentle bleating to keep each other informed of their whereabouts; they also give a peculiar call when water is discovered, and another to inform the flock that there is a stranger in the midst; they also give a peculiar bleat, when a snake or other enemy which they conquer, is observed. Their sense of smell is very acute. Mary Austin says, "Young lambs are principally legs, the connecting body being simply a contrivance for converting milk into more leg, so you understand how it is that they will follow the flock in two days and are able to take the trail in a fortnight, traveling four and five miles a day, falling asleep on their feet and tottering forward in the way."

The older lambs have games which they play untiringly, and which fit them to become active members of the flock; one, is the regular game of "Follow My Leader," each lamb striving to push ahead and attain the place of leader. In playing this the head lamb leads the chase over most difficult places, such as logs, stones and across brooks; thus is a training begun which later in life may save the flock. The other game is peculiar to stony pastures; a lamb climbs to the top of a boulder and its comrades gather around and try to butt it off; the one which succeeds in doing this, climbs the rock and is "it." This game leads to agility and sure-footedness. A lamb's tail is long and is most expressive of lambkin bliss, when feeding time comes; but, alas! it has to be cut off so that later it will not become matted with burrs and filth. In southern Russia there is a breed of sheep with large, flat, fat tails which are esteemed as a great table delicacy. This tail becomes so cumbersome that wheels are placed beneath it, so that it trundles along behind its owner.

Mutual contentment.

We have a noble species of wild sheep in the Rocky Mountains which is likely to become extinct soon. The different breeds of domesticated sheep are supposed to have been derived from different wild species. Of the domesticated varieties, we have the Merinos which originated in Spain and which give beautiful, long, fine wool for our fabrics; but their flesh is not very attractive. The Merinos have wool on their faces and legs and have wrinkled skins. The English breeds of sheep have been especially developed for mutton, although their wool is valuable. Some of these like the Southdown, Shropshire, and Dorset, give a medium length of wool, while the Cotswold has very long wool, the ewes having long strings of wool over their eyes in the fashion of "bangs."

The dog, as descended from the wolf, is the ancient enemy of sheep; and even now after hundreds of years of domestication, some of our dogs will revert to savagery and chase and kill sheep. This, in fact, has been one of the great drawbacks to sheep raising in the Eastern United States. The collie, or sheep-dog, has been bred so many years as the special care-taker of sheep, that a beautiful relationship has been

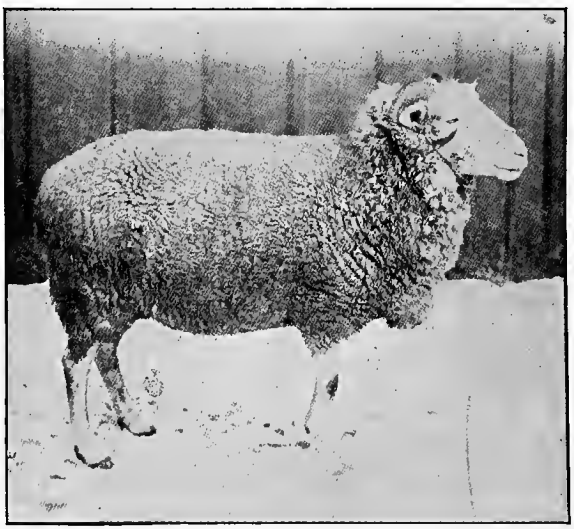
established between these dogs and their flocks. For instances of this, read the chapter on sheep-dogs in A Country Reader; "Wully" in Wild Animals I Have Known, and "Bob, Son of Battle."

LESSON LXVI

The Sheep

Leading thought—Sheep live naturally in high altitudes. When attacked by enemies, they follow their leader over difficult and dangerous mountain places.

Method—The questions of this lesson should be given to the pupils and the observations should be made upon the sheep in pasture or stable. Much written work may be done in connection with this lesson. The following topics are suggested for themes: "The Methods by which Wool is Made into Cloth," "The Rocky Mountain Sheep," "The Sheep-herders of California and their Flocks," "The True Story of a Cosset Lamb."



Horned Dorset ram.

Observations—1. What is the chief character that separates sheep from other animals? What is the difference between wool and hair? Why is wool of special use to sheep in their native haunts? Is there any hair on sheep?

2. Where do the wild sheep live? What is the climate in these places? Does wool serve them well on this account? What sort of pasturage do sheep find on mountains? Could cows live where sheep thrive? Describe the sheep's teeth and how they are arranged to enable it to crop vegetation closely? What happens to the vegetation on the range, when a great flock of sheep passes over it? Why are sheep not allowed in our forest preserves?

3. What are the chief enemies of sheep in the wilderness? How do the sheep escape them? Describe the foot and leg of the sheep and explain how they help the animal to escape its enemies. We say of certain men that they "follow like a flock of sheep." Why do we make this comparison? What has this habit of following the leader to do with the escape of sheep from wolves and bears?

4. How do sheep fight? Do both rams and ewes have horns? Do they both fight? How does the sheep show anger? Give your experience with a cross cosset lamb.

5. Do you think that sheep can see and hear well? What is the position of the sheep's ears when it is peaceful? When there is danger? How do the sheep's eyes differ from those of the cow?

6. Does the sheep chew its cud like the cow? Describe the actionas performed by the sheep. How is this habit of cud chewing of use to the wild sheep?

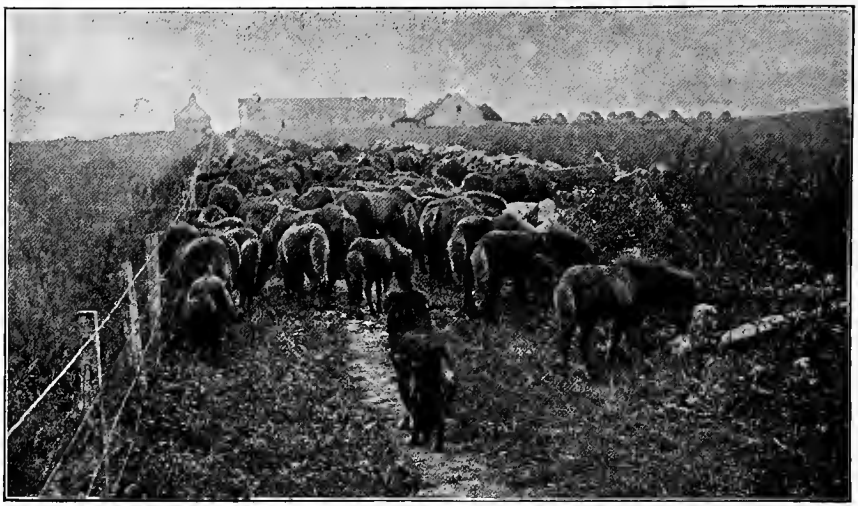
7. Describe a young lamb. Why has it such long legs? How do es it use its tail to express joy? What happens to this tail later? What games have you seen lambs play? Tell all the stories of lambs that you know.

8. How much of sheep language do you understand? What is the use to the wild flock of the constant bleating?

9. For what purposes do we keep sheep? How many breeds of sheep do you know? What are the chief differences between the English breeds and the Merinos? Where and for what purposes is the milk of sheep used?

10. Have you ever seen a collie looking after a herd of sheep? If so, describe his actions. Did you ever know of dogs killing sheep? At what time of day or night was this done? Did you ever know of one dog attacking a flock of sheep alone. What is there in the dog's ancestry which makes two or three dogs, when hunting, give chase and attack sheep?

Photo by Gerrit Miller



A herd of ponies in the Isle of Shetland guarded by a sheep-dog.

THE HORSE

Teacher's Story

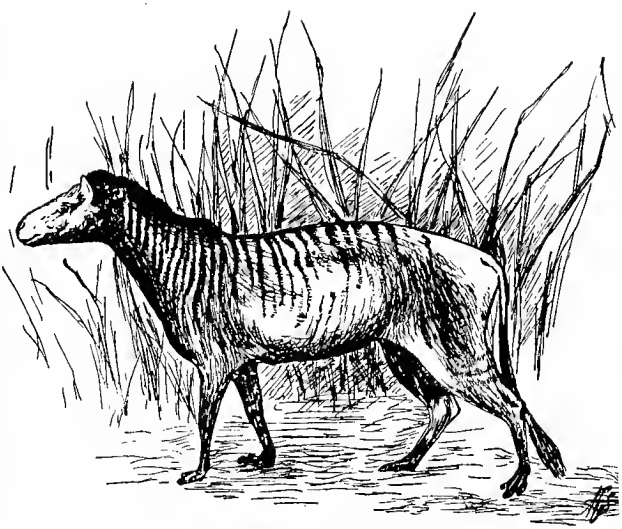
"There was once a little animal no bigger than a fox,
And on five toes he scrambled over Tertiary rocks.
They called him Eohippus, and they called him very small,
And they thought him of no value when they thought of him at all.

Said the little Eohippus, I am going to be a horse!
And on my middle finger nails to run my earthly course!
I am going to have a flowing tail! I am going to have a mane!
And I am going to stand fourteen hands high on the Psychozooic plain!"

—Mrs. Stetson.

It was some millions of years ago, that Eohippus lived out in the Rocky Mountain Range; its fore feet had four toes and the splint of the fifth; the hind feet had three toes and the splint of the fourth. Eohippus was followed down the geologic ages by the Orohippus and the Mesohippus and various other hippuses, which showed in each age a successive enlargement and specialization of the middle toe and the minimizing and final loss of the others. This first little horse with many toes, lived when the earth was a damp, warm place and when animals needed toes to spread out to prevent them from miring in the mud. But as the ages went on, the earth grew colder and drier, and a long leg ending in a single hoof, was very serviceable in running swiftly over the dry plains; and according to the story read in the fossils of the rocks, our little American horses migrated to South America; and also trotted dry-shod over to Asia in the Mid-pleocine age, arriving there sufficiently early to become the companion of prehistoric man. In the meantime, horses were first hunted by

savage man for their flesh, but were later ridden. At present, there are wild horses in herds on the plains of Tartary; and there are still sporadic herds of mustangs on the great plains of our own country, although for the most part, they are branded and belong to someone, even though they live like wild horses; these American wild horses are supposed to be descendents of those brought over centuries ago by the Spaniards. The Shetland ponies are also wild in the islands north of Scotland, and the zebras roam the plains of Africa the most truly wild of all. In a state of wildness, there is always a stallion at the head of a herd of mares, and he has to win his position and keep it by superior strength and prowess. Fights between stallions are terrible to witness, and often result in the death of one of the participants. The horse is well armed for battle; his powerful teeth can inflict deep wounds and he can kick and strike hard with the front feet; still more efficient is the kick made with both hind feet while the weight of the body is borne on the front feet, and the head of the horse is turned so as to aim well the terrible blow. There are no wild beasts of prey which will not slink away to avoid a herd of horses. After attaining their growth in the herd with their mothers, the young males are forced by the leader to leave and go off by themselves; in turn, they must by their own strength and attractions, win their following of mares. However, there are times and places where many of these herds join, making large bands wandering together.

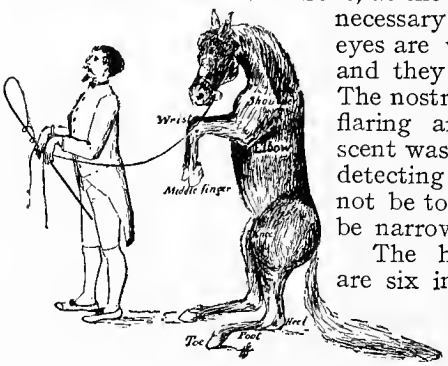


Four-toed horse of the Eocene period.
After Charles R. Knight.

The length of the horse's leg was evidently evolved to meet the need for flight before fierce and swift enemies, on the great ancient plains. The one toe, with its strong, sharp hoof, makes a fit foot for such a long leg, since it strikes the ground with little waste of energy and is sharp enough not to slip, but it is not a good foot for marshy places; a horse will mire where a cow can pass in safety. The development of the middle toe into a hoof results in lifting the heel and wrist far up the leg, making them appear to be the knee and elbow, when compared with the human body.

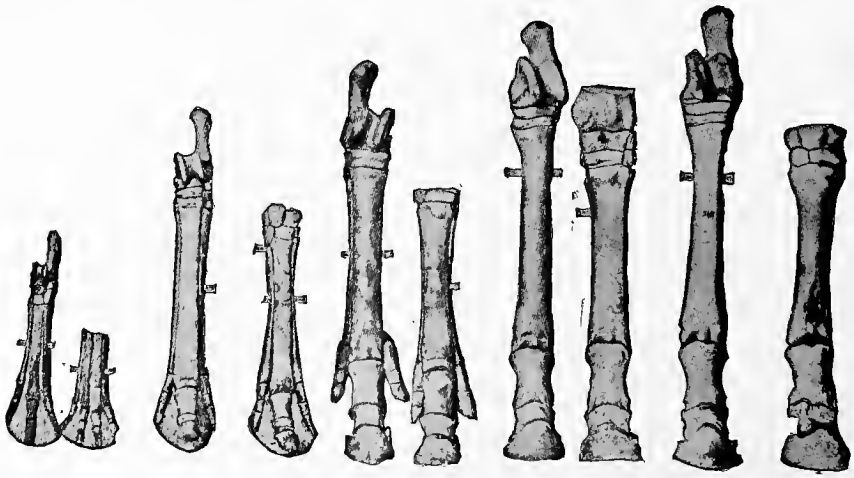
The length of neck and head are necessary in order that an animal, with such length of leg as the horse, may be able to graze. The head of the horse tells much of its disposition; a perfect head should be not too large, broad between the eyes and high between the ears, while below the eyes, it should be narrow. The ears, if lopped or turned back, denote a treacherous disposition. They should point upward or forward; the ears laid back is always a sign that the horse is angry; sensitive, quick-moving

ears indicate a high-strung, sensitive animal. The eyes are placed so that the horse can see in front, at the side and behind, the last being necessary in order to aim a kick. Hazel eyes are usually preferred to dark ones, and they should be bright and prominent. The nostrils should be thin-skinned, wide-flaring and sensitive; as a wild animal, scent was one of the horse's chief aids in detecting the enemy. The lips should not be too thick and the lower jaw should be narrow where it joins the head.



The horse's teeth are peculiar; there are six incisors on both jaws; behind them is a bare space called the bar, of which we have made use for placing the bit. Back of the bar, there are six molars or grinders on each side of each jaw. At the age of about three years, canine teeth or tushes appear behind the incisors; these are more noticeable in males, and never seem to be of much use. Thus, the horse has on each jaw, when full-grown, six incisors, two canines, and twelve molars, making forty teeth in all. The incisors are prominent and enable the horse to bite the grass more closely than can the cow. The horse when chewing, does not have the sidewise motion of the jaws peculiar to the cow and sheep.

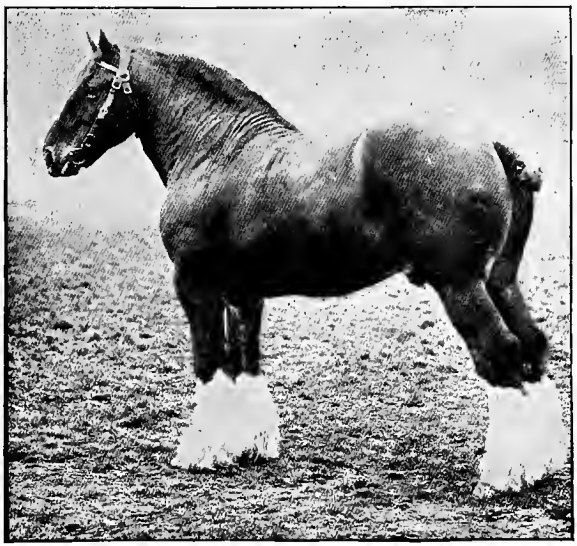
The horse's coat is, when rightly cared for, glossy and beautiful; but if the horse is allowed to run out in the pasture all winter, the coat becomes very shaggy, thus reverting to the condition of wild horses which stand in need of a warmer coat for winter; the hair is shed every year. The mane and the forelock are useful in protecting the head and neck from flies; the tail is also an efficient fly-brush. Although the mane and tail



Hoofs of horses from earliest ages to the present time, arranged in pairs, hind and front.

have thus a practical value, they add greatly to the animal's beauty. To dock a horse's tail as an ornament is as absurd as the sliced ears and welted cheeks of savages; and horses thus mutilated suffer greatly from the attacks of flies.

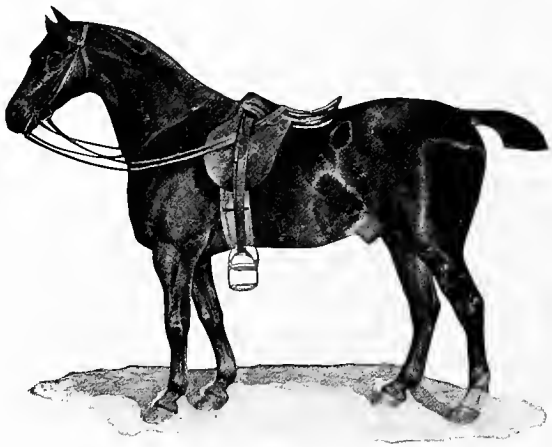
Owing to the fact that wild horses made swift flight from enemies, the colts could not be left behind at the mercy of wolves. Thus it is, the colt like the lamb, is equipped with long legs from the first, and can run very rapidly; as a runner, it could not be loaded with a big compound stomach full of food, like the calf, and therefore, must needs take its nourishment from the mother often. The colt's legs are so long that, in order to graze, it spreads the front legs wide apart in order that it may reach the grass with its mouth. When the colt or the horse lies down out of doors and in perfect freedom, it lies flat upon the side. In lying down, the hind quarters go first, and in rising, the front legs are thrust out first.



English draft-horse.

The horse has several natural gaits and some that are artificial. Its natural methods of progression are the walk, the trot, the amble, the gallop. When walking there are always two or more feet on the ground and the movement of the feet consists in placing successively the right hind foot, the right fore foot, left hind foot, left fore foot, right hind foot, etc. In trotting, each diagonal pair of legs is alternately lifted and thrust forward, the horse being unsupported twice during each stride. In ambling, the feet are moved as in the walk, only differing in that a hind foot or a fore foot is lifted from the ground, before its fellow fore foot or hind foot is set down. In a canter, the feet are landed on the ground in the same sequence as a walk but much more rapidly; and in the gallop, the spring is made from the fore foot and the landing is on the diagonal hind foot and just before landing, the body is in the air and the legs are all bent beneath it.

An excellent horseman once said to me, "The whip may teach a horse to obey the voice, but the voice and hand control the well-broken horse," and this epitomizes the best horse training. He also said, "The horse knows a great deal, but he is too nervous to make use of his knowledge when he needs it most. It is the horse's feelings that I rely on. He always has the use of his feelings and the quick use of them." It is a well-known fact that those men who whip and scold and swear at their horses, are meantime showing to the world that they are fools in this particular business. Many of the qualities which we do not like in our domesticated horses, were most excellent and useful when the horses were wild, for instance, the habit of shying was the wild horse's method of escaping the crouching foe in the grass. This habit as well as many others



Saddle-horse.

is best controlled by the voice of the driver instead of a blow from the whip.

Timothy hay, or hay mixed with clover, form good, bulky food for the horse, and oats and corn are the best concentrated food. Oats are best for driving-horses and corn for the working team. Dusty hay should not be fed to a horse; but if unavoidable, it should always be dampened before feeding. A horse should be fed with regularity, and should not be used for a short time after having eaten. If the horse is not warm, it should be watered before feeding, and in the winter the water should have the chill taken off. The frozen bit should be warmed before being placed in the horse's mouth; if anyone doubts the wisdom of this, let him put a frozen piece of steel in his own mouth. The tight-drawn, cruel use of the over check-rein should not be permitted, although a moderate check is often needed and is not cruel. When the horse is sweating, it should be blanketed immediately if hitched outside in cold weather; but in the barn, the blanket should not be put on until the perspiration has stopped steaming. The grooming of a horse is a part of its rights, and its legs should receive more attention during this process than its body, a fact not always well understood.

The breeds of horses may always be classified more or less distinctly as follows: Racers or thoroughbreds; the saddle-horse, or hunter; the

coach-horse; the draft-horse and the pony. For a description of breeds see dictionaries or cyclopedias. Of the draft-horses, the Percherons, Shires and Clydesdales are most common; of the carriage and coach-horses, the English hackney and the French and German coach-horses are famed examples. Of the roadster breeds, the American trotter, the American saddle-horse and the English thoroughbred are most famous.

A good coacher.

LESSON LXVII

The Horse

Leading thought—The horse as a wild animal depended largely upon its strength and fleetness to escape its enemies, and these two qualities have made it of greatest use to man.

Method—Begin this study of the horse with the stories of wild horses. "The Pacing Mustang" in Wild Animals I Have Known, is an excellent story to show the habits of the herds of wild horses; Chapter first in A Country Reader and the story of horses in Life of Animals are excellent as a basis for study. Before beginning actual study of the domestic horses, ask for oral or written English exercises descriptive of the lives of the wild horses. Get Remington's pictures illustrating the wild horses of America. After the interest has been thus aroused the following observations may be suggested, a few at a time, to be made incidentally in the street or in the stable.

Observations—1. Compare the length of the legs of the horse with its height. Has any other domestic animal legs as long in proportion? What habits of the ancestral wild horses led to the development of such long legs? Do you think the length of the horse's neck and head correspond to the length of its legs? Why?

2. Study the horse's leg and foot. The horse walks on one toe. Which toe do you think it is? What do we call the toe-nail of the horse? What advantage is this sort of a foot to the horse? Is it best fitted for running on dry plains or for marshy land? Does the hoof grow as our nails do? Do you know whether there were ever any horses with three toes or four toes on each foot? Make a sketch of the horse's front and hind leg and label those places which correspond to our wrist, elbow, shoulder, hand, heel, knee and hip.

3. Where are the horse's ears placed on the head? How do they move? Do they flap back and forth like the cow's ears when they are moved, or do they turn as if on a pivot? What do the following different positions of the horse's ears indicate: When lifted and pointing forward? When thrown back? Can you tell by the action of the ears whether a horse is nervous and high-strung or not?

4. What is the color of the horse's eyes? The shape of the pupil? What advantage does the position of the eyes on the head give to the wild horse? Why do we put blinders on a horse? Can you tell by the expression of the eye the temper of the horse?

5. Look at the mouth and nose. Are the nostrils large and flaring? Has the horse a keen sense of smell? Are the lips thick or thin? When taking sugar from the hand, does the horse use teeth or lips?

6. Describe the horse's teeth. How many front teeth? How many back teeth? Describe the bar where the bit is placed. Are there any

"Palo Alto", a famous running horse.

canine teeth? If so, where? Do you know how to tell a horse's age by its teeth? (See Elements of Agriculture, Warren, page 304, and The Horse, Roberts, page 246.) Can a horse graze the grass more closely than a cow? Why? When it chews does it move the jaws sidewise like the cow? Why? Why did the wild horses not need to develop a cud-chewing habit?

7. What is the nature of the horse's coat in summer? If the horse runs in the pasture all winter, how does its coat change? When does the horse shed its coat? What is the use of the horse's mane, forelock and tail? Do you think it is treating the horse well to dock its tail?

8. Why do colts need to be so long-legged? How does a colt have to place its front legs in order to reach down and eat the grass? Does the colt need to take its food from the mother often? How does it differ from the calf in this respect? How has this difference of habit resulted in a difference of form in the calf and colt?

9. When the horse lies down which part goes down first? When getting up which rises first? How does this differ from the method of the cow? When the horse lies down to sleep does it have its legs partially under it like the cow?

10. In walking which leg moves first? Second? Third? Fourth? How many gaits has the horse? Describe as well as you can all of these gaits. (See pictures illustrating the word "movement" in the Standard Dictionary.)

11. Make a sketch of a horse showing the parts. (See Webster's Unabridged). When we say a horse is fourteen hands high what do we mean?

12. In fighting, what weapons does the horse use and how?

13. In training a horse, should the voice or the whip be used the most? What qualities should a man have to be a good horse trainer? Why is shying a good quality in wild horses? How should it be dealt with in the domestic horse?

14. What sort of feed is best for the horse? How and when should the horse be watered? Should the water be warmed in cold weather? Why? Should the bit be warmed in winter before putting it in a horse's mouth? Why? Should a tight over check-rein be used when driving? Why? When the horse has been driven until it is sweating what are the rules for blanketing it when hitched out of doors and when hitched in the barn? What is your opinion of a man who lets his horse stand waiting in the cold, unblanketed in the village street. If horses were kept out of doors all the time would this treatment be so cruel and dangerous? Why? Why should dusty hay be dampened before it is fed to a horse? Why should a horse be groomed? Which should receive the most attention, the legs or the body?

15. How many breeds of horses do you know? What is the use of each? Describe as well as you can the characteristics of the following breeds: The thoroughbred, the hackney, and other coach-horses; the American trotter, the Percheron, the Clydesdale.

16. Write English themes on the following subjects: "The Prehistoric Horses of America," "The Arabian Horse and Its Life With Its Master," "The Bronchos and Mustangs of the West," "The Wild Horses of Tartary," "The Zebras of Africa," "The Shetland Ponies and the Islands on Which They Run Wild."

Supplementary reading—The Horse, Roberts; Elements of Agriculture, Warren; Life of Animals, Cram; Neighbors with Claws and Hoofs; A Country Reader; Agriculture for Beginners; Black Beauty; John Brent, by Theodore Withrop; Half Hours with Mammals, Holder; Chapters on Animals, Hammerton; "Kaweah's Run" in Claws and Hoofs.

Many horses shy a good deal at objects they meet on the road. This mostly arises from nervousness, because the objects are not familiar to them. Therefore, to cure the habit, you must get your horse accustomed to what he sees, and so give him confidence. . . . Be careful never to stop a horse that is drawing a vehicle or load in the middle of a hill, except for a rest; and if for a rest, draw him across the hill and place a big stone behind the wheel, so that the strain on the shoulder may be eased. Unless absolutely necessary never stop a horse on a hill or in a rut, so that when he starts again it means a heavy tug. Many a horse has been made a jibber and his temper spoilt by not observing this rule.

—H. B. M. Buchanan in "A Country Reader."

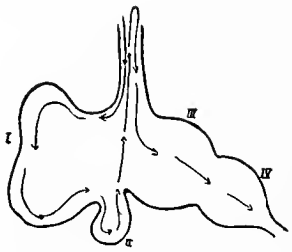
The original wild cattle of America.
Photo by John L. Rich.

CATTLE

Teacher's Story

That in numbers there is safety, is a basic principle in the lives of wild cattle, probably because their chief enemies, the wolves, hunted in packs. It has often been related that, when the herd is attacked by wolves, the calves are placed at the center of the circle made by the cattle, standing with heads out and horns ready for attack from every quarter. But when a single animal, like a bear or tiger, attacks any of the herd, they all gather around it in a narrowing circle of clashing horns, and many of these great beasts of prey have thus met their death. The cow is as formidable as the bull to the enemy, since her horns are strong and sharp and she tosses her victim, unless it is too large. The heavy head, neck and short massive horns of the bull, are not so much for defence against enemies as against rival bulls. The bull not only tosses and gores his victim, but kneels or tramples upon it. Both have effective weapons of defence in the hind feet, which kick powerfully. The buffalo bull of India will attack a tiger single handed, and usually successfully. It is a strange thing that all cattle are driven mad by the smell of blood, and weird stories are told of the stampeding of herds from this cause, on the plains of our great West.

Cattle are essentially grass and herbage eaters, and their teeth are peculiarly arranged for this. There are eight front teeth on the lower jaw, and a horny pad opposite them on the upper jaw. Back of these on each jaw there is a bare place and six grinding teeth on each side. As a cow crops the herbage, her head is moved up and down to aid in severing the leaves, and the peculiar sound of the tearing of the leaves thus made is not soon forgotten by those who have heard it. In the wild or domesticated state the habit of cud-chewing is this: The cattle graze in mornings and evenings, swallowing the food as fast as cropped, and storing it



Course of food in a cow's stomach.
I, ruminant stomach; II, where the cud-balls are formed; III, IV, true stomachs.

in their ruminating stomachs. During the heat of the day, they move to the shade, preferably to the shady banks of streams, and there in quiet the food is brought up, a small portion at a time, and chewed with a peculiar sidewise movement of the jaws and then swallowed, passing to the true stomach. There is probably no more perfect picture of utter contentment, than a herd of cows chewing their cuds in the shade, or standing knee-deep in the cool stream on a summer's day. The cattle in a herd when grazing, keep abreast and move along, heads in the same direction.

Connected with the grazing habit, is that of the hiding of the new-born calf by its mother; the young calf is a wabbly creature and ill-fitted for a long journey; so the mother hides it, and there it stays "frozen" and will never stir unless actually touched. As the mother is obliged to be absent for some time grazing with the herd, the calf is obliged to go without nourishment for a number of hours, and so it is provided with a large compound stomach which, if filled twice per day, suffices to insure health and growth. The cow, on the other hand, giving her milk out only twice per day, needs a large udder in which to store it. The size of the udder is what has made the cow useful to us as a milch animal.

A fine cow is a beautiful creature, her soft yellow skin beneath the sleek coat of short hair, the well proportioned body, the mild face, crowned with spreading, polished horns and illuminated with large gentle eyes, are all

A pet Holstein.

elements of beauty which artists have recognized, especially those of the Dutch school. The ancients also admired bovine eyes, and called their most beautiful goddess the ox-eyed Juno.

The cow's ears can be turned in any direction, and her sense of hearing is keen; so is her sense of smell, aided by the moist, sensitive skin of the nose; she always sniffs danger and also thus tests her food. Although a cow if well kept has a sleek coat, when she is allowed to run out of doors during the winter, her hair grows long and shaggy as a protection. The cow walks on two toes, or as we say has a split hoof. She has two lesser toes above and behind the hoofs which we call dew-claws. The part of her leg which seems at first glance to be her knee, is really her wrist or ankle. Although short-legged, the cow is a good runner, as those who have chased her can bear witness. She can walk, gallop and has a pacing trot; she is a remarkable jumper, often taking a fence like a deer; she also has marvelous powers as a swimmer, a case being on record where a cow swam five miles. But a cow would be illy equipped for comfort if it were not for her peculiar tail, which is made after the most approved pattern of fly-brushes, and is thus used. Woe betide the fly she hits with it, if the blow is as efficient as that which she incidentally bestows on the head of the milker. It is to get rid of flies, that the cattle, and especially the buffaloes, wallow in the mud, and thus coat themselves with a fly-proof armor.

There is a fairly extensive range of emotions expressed in cattle language, from the sullen bellow of the angry animal to the lowing which is the call of the herd, and the mooing which is meant for the calf; and there are many other bellowings and mutterings which we can partially understand.

Every herd of cows has its leader, which has won the position by fair fight. Add a new cow to the herd, and there is at once a trial of strength, to adjust her to her proper place; and in a herd of cows, the leader leads; she goes first and no one may say her nay. In fact, each member of the herd has her place in it; and that is why it is so easy to teach cows each to take her own stanchion in the stable. In a herd of forty cows which I knew, each cow took her stanchion, no matter in what order she happened to enter the stable.

A cow at play is a funny sight; her tail is lifted aloft like a pennant and she kicks as lightly as if she were made of rubber. She is also a sure-footed beast, as anyone can attest who has seen her running down the rocky mountain sides of the Alps, at a headlong pace and never making a mistake. In lying down, the cow first kneels with the front legs, or rather drops on her wrists, and then the hind quarters go down, and then the front follow. She does not lie flat on her side when resting, like the horse when at ease, but with her legs partially under her. In getting up, she rests upon her wrists and then lifts the hind quarters.

The Usefulness of Cattle

When man emerged from the savage state, his first step toward civilization was domesticating wild animals and training them for his own use. During the nomad stage, when tribes wandered over the face of the earth, they took their cattle along. From the first, these animals have been used in three capacities: First, for carrying burdens and as draught

animals; second, as meat; third, as givers of milk. They were also used in the earlier ages as sacrifices to the various deities, and in Egypt, some were held as sacred.

As beasts of burden and draft animals, oxen are still used in many parts of the United States. For logging, especially in pioneer days, oxen were far more valuable than horses. They are patient and will pull a few inches at a time, if necessary, a tedious work which the nervous horse refuses to endure. Cows too, have been used as draft animals, and are so used in China today, where they do most of the plowing; in these oriental countries milk is not consumed to any extent, so the cow is kept for the work she can do. In ancient times in the East, white oxen formed a part of royal processions.

Beef cattle.

Because of two main uses of cattle by civilized man, he has bred them in two directions; one for producing beef, and one for milk. The beef cattle are chiefly Aberdeen-Angus, Galloway, Short-horn or Durham, and Hereford; the dairy breeds are the Jersey, Guernsey, Ayrshire, Holstein-Frisian and Brown Swiss. The beef animal is, in cross-section, approximately like a brick set sidewise. It should be big and full across the loins and back, the shoulders and hips covered heavily with flesh, the legs stout, the neck thick and short, and the face short; the line of the back is straight, and the stomach line parallel with it. Very different is the appearance of the milch cow. Her body is oval, instead of being approximately square in cross-section. The outline of her back is not straight,

but sags in front of the hips, which are prominent and bony. The shoulders have little flesh on them; and if looked at from above, her body is wedge-shaped, widening from shoulders backward. The stomach line is not parallel with the back bone, but slants downward from the shoulder to the udder. The following are the points that indicate a good milch cow: Head high between the eyes, showing large air passages and indicating strong lungs. Eyes clear, large and placid, indicating good disposition. Mouth large, with a muscular lower jaw, showing ability to chew efficiently and rapidly. Neck, thin and fine, showing veins through the skin. Chest deep and wide, showing plenty of room for heart and lungs. Abdomen, large but well supported, and increasing in size toward the rear. Ribs, well spread, not meeting the spine like the peak of a roof, but the spine must be prominent, revealing to the touch the separate vertebræ. Hips, much broader than the shoulders. Udder, large, the four quarters of equal size, and not fat; the "milk veins" which carry the blood from the udder should be large and crooked, passing into the abdomen through large openings. Skin, soft, pliable and covered with fine, oily hair. She should have good digestion and great powers of assimilation. The milch cow is a milk-making machine, and the more fuel (food) she can use, the greater her production.

The physiological habits of the beef and milch cattle have been changed as much as their structure. The food given to the beef cow goes to make flesh; while that given to the milch cow goes to make milk, however abundant her food. Of course, there are all grades between the beef and the milch types, for many farmers use dual herds for both. However, if a farmer is producing milk it pays him well to get the best possible machine to make it, and that is always a cow of the right type.

A Geography Lesson

All the best breeds of cattle have been evolved in the British Isles and in Europe north of Italy and west of Russia. All our domesticated cattle were developed from wild cattle of Europe and Asia. The cattle which roam in our rapidly narrowing grazing lands of the far West are European cattle. America had no wild cattle except the bison. In geography supplementary readers, read about Scotland, England, the Channel Islands, the Netherlands, France and Switzerland and the different kinds of cattle developed in these countries; for example, "A Holland Dairy," in Northern Europe, Ginn & Co.

How to Produce Good Milk

There are three main ingredients of milk—fat, curd and ash. The fat is for the purpose of supplying the animal with fat and we make it into butter; the curd supplies muscle, or the lean meat of the animal, and is the main ingredient of cheese, although cheese to be good should contain a full amount of butter fat; the ash which may be seen as residue when milk is evaporated, builds up the bone of the animal. The best butter cows are those which give a larger per cent. of fat and a small per cent. of curd, like the Jerseys; the best cheese cows are those which give a fair per cent. of fat and a larger yield of curd, like the Ayrshire and Holstein.

A cow for producing cheese, is not profitable, unless she gives seven thousand pounds of milk per year; a butter cow, a Jersey for instance, should produce five thousand pounds of milk per year to be really profitable.

The stable where milch cows are kept should be thoroughly cleaned before each milking, and should be swept each day; the cows' udders should be brushed, and the milkers should wear clean aprons and should wash their hands before milking. Milk should never be strained in the barn, but in some place where the air is fresh. If milk is perfectly clean, it will keep sweet much longer; sterilized milk put in bottles will keep sweet for weeks and even months. Loud talking should not be permitted in the stables while the cows are being milked, and each cow should be milked by the same person for the entire season.

The perfect milch type.

Milk to be legally sold in New York State must possess three per cent. of butter fat. For upper grades or first year work in the high school, there could not be a more profitable exercise than teaching the pupils the use of the Babcock milk tester.

The Care of the Milch Cow

The importance cannot be over-estimated of teaching the pupils in rural districts, the proper care of milch cattle for the production of milk. The milch cow is a perfect machine, and should be regarded as such in producing milk. First, she should have plenty of food of the right kind, that is, a well-balanced ration. Second, she should have a warm, clean stable and be supplied with plenty of good, fresh air. A cold stable makes it necessary to provide much more food for the cow; a case on record shows that when a barn was opened up in cold weather for necessary repairing, the amount of milk from the cows stabled in it, decreased ten per cent. in twenty-four hours. There should be a protected place for

drinking, if the cattle must be turned out of the barn for water in winter; it is far better to have the water piped into the barn, although the herd should be given a few hours each day in the open air. A dog should never be used for driving cows. To be profitable, a cow should give milk ten months of the year at least. Calves should be dehorned when they are a few days old by putting caustic potash on the budding horns, thus obviating the danger of damaging the cow by dehorning.

In a properly run dairy, a pair of scales stands near the can for receiving the milk; and as the milk from each cow is brought in, it is weighed and the amount set down opposite the cow's name on a "milk sheet," that is tacked on the wall, near by. At the end of each week, the figures on the milk sheet are added, and the farmer knows just how much milk each cow is giving him, and whether there are any in the herd which are not paying their board.

References—Elements of Agriculture, Warren; Agriculture for Beginners, Burkett, Stevens and Hill, p. 216; First Principles of Agriculture, Vorhees, p. 117; Elements of Agriculture, Sever, p. 57; Elements of Agriculture, Shepperd, chapters 15 and 22; First Principles of Agriculture, Goff and Maine, p. 154; Agriculture Through the Laboratory, School and Garden, Jackson and Dougherty, chapter 8; The Dairy Herd, Farmers' Bulletin No. 55, U. S. Dept. of Agr.; Care of Milk on the Farm, Farmers' Bulletin No. 63, U. S. Dept. of Agr.

LESSON LXVIII

The Cow

Leading thought—Certain characteristics which enable the cow to live successfully as a wild animal, have rendered her of great use to us as a domestic animal.

Method—Begin the lesson with leading the pupils to understand the peculiar adaptation of cattle for success, as wild animals. This will have to be done largely by reading and asking for oral or written work on the following topics: "The Aurochs," "Wild Cattle of the Scottish Highlands," "The Buffaloes of the Orient," "The American Bison," "The Cow-boys of the West and their Work with their Herds," "The Breeds of Beef Cattle, Where they Came From, and Where Developed," "The Breeds of Milch Cattle, their Origin and Names." The following questions may be given out a few at a time and answered as the pupils have opportunity for observation.

Observations—1. What are the characteristics of a fine cow? Describe her horns, ears, eyes, nose and mouth. Do you think she can hear well? What is the attitude of her ears when she is listening? Do you think she has a keen sense of smell? Is her nose moist? Is her hair long or short? Smooth or rough?

2. The cow walks on two toes. Can you see any other toes which she does not walk on? Why is the cow's foot better adapted than that of the horse, to walk in mud and marshes? What do we call the two hind toes which she does not walk on? Can you point out on the cow's leg those parts which correspond with our elbow, wrist, knee and ankle? Is the cow a good runner? Is she a good jumper? Can she swim?

3. For what use was the cow's tail evidently intended? How do the wild buffalos and bisons get rid of attacks of flies?

4. How much of cattle language do you understand? How does the cow express pleasure? Lonesomeness? Anger? How does the bull express anger? What does the calf express with the voice?

5. Is there always a leader in a herd of cows? Do certain cows of the herd always go first and others last? Do the cows readily learn to take each her own place in the stable? How is leadership of the herd attained? Describe cattle at play.

6. At what time of day do cattle feed in the pasture? When and where do they chew the cud? Do they stand or lie to do this? Describe how a cow lies down and gets up.

7. How do wild cattle defend themselves from wolves? From bears or other solitary animals?

8. For what purposes were cattle first domesticated? For how many purposes do we rear cattle today?

9. Name and give brief descriptions of the different breeds of cattle with which you are familiar. Which of these are beef and which milch types?

10. What are the distinguishing points of a good milch cow? Of a good beef animal? What does the food do for each of these? Which part of the United States produces most beef cattle? Which the most milch cattle?

11. What do we mean by a balanced ration? Do you know how to compute one? What is the advantage of feeding cattle a balanced ration?

12. How many pounds of milk should a dairy cow produce in a year to be profitable if the product is cheese? If the product is butter? Why this discrepancy? What must be the per cent. of butter fat in milk to make it legally salable in your state? How many months of the year should a good cow give milk?

13. Why should a cow be milked always by the same person? Does the milker always sit on the same side? Why should loud talking and other noise at milking time be avoided? Should a dog be used in driving dairy cows? Why?

14. Why is a cool draughty barn an expensive place in which to keep cattle? Why is a barn not well-ventilated, a danger?

15. Why and where is the dehorning of cattle practiced? When and how should a calf be dehorned?

16. Why should milk not be strained in the barn? Why is it profitable for the dairy farmer to keep his stable clean and to be cleanly in the care of milk? How does the food of cows affect the flavor of the milk? Why should a farmer keep a record of the number of pounds of milk which each cow in his dairy gives each day?

17. For what are oxen used? Wherein are they superior to horses as draft animals? Do you know of any place where oxen are used as riding animals?

18. How many industries are dependent upon cattle?

19. Give oral or written exercises on the following themes: "How the Best Butter is Made;" "The Use of Bacteria in Butter;" "How Dairy Cheese is Made;" "How Fancy Cheeses are Made."

THE PIG

Teacher's Story

"I wander through the underbresh,
Where pig tracks pintin' to'rds the crick,
Is picked and printed in the fresh
Black bottom-lands, like wimmen prick
Their pie-crust with a fork."—RILEY.

BY a forest law of William the First of England in the eleventh century, it was ordained that any that were found guilty of killing the stag or the roebuck or the wild boar, should have their eyes put out. This shows that the hunting of the wild boar in England was considered a sport of gentlemen in an age when nothing was considered sport unless it was dangerous. The wild hog of Europe is the ancestor of our common domesticated breeds; although independent of these, the Chinese domesticated their own wild species, even before the dawn of history.

The wild hog likes damp situations where it may wallow in the water and mud; but it also likes to have, close by, woods, thicket or underbrush, to which it can retire for rest and also when in danger. The stiff, bristling hairs which cover its thick skin, are a great protection when it is pushing through thorny thickets. When excited or angry, these bristles rise and add to the fury of its appearance. Even in our own country, the wild hogs of the South whose ancestors escaped from domestication, have reverted to their original savagery, and are dangerous when infuriated. The only recorded instance when our great national hunter, Theodore Roosevelt, was forced ignominiously to climb a tree, was after he

Anxious for dinner.

had emptied his rifle into a herd of "javelins," as the wild pigs of Texas are called; the javelins are the peccaries, which are the American representatives of the wild hog.

That the hog has become synonymous with filth is the result of the influence of man upon this animal, for of all animals, the pig is naturally the neatest, keeping its bed clean, often in the most discouraging and ill-kept pens. The pig is sparsely clothed with bristles and hairs, which yield it no protection from the attacks of flies and other insects. Thus it is the pig, in order to rid itself of these pests, has learned to wallow in the mud. However, this is in the nature of a mud bath, and is for the purpose of keeping the body free from vermin. The wild hogs of India make for themselves grass huts, thatched above and with doors at the sides, which shows that the pig, if allowed to care for itself, understands well the art of nest-building.

One of the most interesting things about a pig, is its nose; this is a fleshy disc with nostrils in it and is a most sensitive organ of feeling; it can select grain from chaff, and yet is so strong that it can root up the ground in search for food. "Root" is a pig word, and was evidently coined to describe the act of the pig when digging for roots; the pig's nose is almost as remarkable as the elephant's trunk, and the pig's sense of smell is very keen; it will follow a track almost as well as a dog. There are more instances than one of a pig being trained as a pointer for hunting birds, and showing a keener sense of smell, and keener intelligence in this capacity, than do dogs. French pigs are taught to hunt for truffles, which are fungi growing on tree roots, a long way below the surface of the ground; the pig detects their presence through the sense of smell.

The pig has a full set of teeth, having six incisors, two canines and seven grinding teeth on each jaw; although in some cases there are only four incisors on the upper jaw. A strange thing about a pig's teeth, is the action of the upper canines, or tushes, which curve upward instead of downward; the lower canines grind up against them, and are thus sharpened. The females have no such development of upper tushes as do the males; these tushes, especially the upper ones, are used as weapons; with them, the wild boar slashes out and upward, inflicting terrible wounds, often disabling horses and killing men. Professor H. F. Button describes the fighting of hogs thus: "To oppose the terrible weapons of his rival, the boar has a shield of skin over his neck and shoulders, which may become two inches thick, and so hard as to defy a knife. When two of these animals fight, each tries to keep the tushes of his opponent against the shield, and to get his own tushes under the belly or flank of the other. Thus, each goes sidewise or in circles, which has given rise to the expression, 'to go sidewise like a hog to war.' "

When, as a small girl, I essayed the difficult task of working buttonholes, I was told if I did not set my stitches more closely together, my buttonhole would look like a pig's eye, a remark which made me observant of that organ ever after. But though the pig's eyes are small, they certainly gleam with intelligence, and they take in all that is going on, which may in any way affect his pigship.

The pig is the most intelligent of all the farm animals, if it is only given a chance; it has excellent memory and can be taught tricks readily; it is affectionate and will follow its master around like a dog. Anyone who has seen a trained pig at a show picking out cards and counting, must

grant that it has brains, although we stuff it so with fattening food, that it does not have a chance to use its brain, except now and then when it breaks out of the sty and we try to drive it back. Under these circumstances, we grant the pig all the sagacity usually imputed to the one who once possessed swine and drove them into the sea. Hunters of wild hogs proclaim that they are full of strategy and cunning, and are exceedingly fierce. We pay tribute to the pig's cleverness when free to outwit us, when we say of other uncertain undertakings, that they are like "buying a pig in a poke."

The head of the wild hog is wedge-shaped with pointed snout, and this form enables the animal to push into the thick underbrush along the river banks, whenever it is attacked. But civilization has changed this bold profile of the head, so that now in many breeds, there is a hollow between the snout and eyes, giving the form which we call "dished." Some breeds have sharp, forward-opening ears, while others have ears that lop. The wild pig of Europe and Asia has large, open ears extending out wide and alert on each side of the head.

Good for the pigs and good for the orchard.

The covering of the pig is a thick skin beset with bristling hairs; when the hog is excited, the bristles rise and add to the fury of its appearance. The bristles aid in protecting the animal when it is pushing through thorny thickets. The pig's querly tail is merely an ornament, although the tail of the wart hog of Africa, if pictures may be relied upon, might be used in a limited fashion as a fly-brush.

When the pig is allowed to roam in the woods, it lives on roots, nuts, and especially acorns and beech nuts; in the autumn it becomes very fat through feeding upon the latter. The mast-fed bacon of the semi-wild hogs of the Southern States is considered the best of all. But almost anything animal or vegetable, that comes in its way, is eaten by the hog, and it has been long noted that the hog has done good service on our frontier as a killer of rattlesnakes. The pig is well fitted for locomotion on either wet or dry soil, for the two large hoofed toes enable it to walk well on dry ground and the two hind toes, smaller and higher up, help to sustain it on marshy soil. Although the pig's legs are short, it is a swift runner unless it is too fat. The razor-backs of the South are noted for their fleetness.

We understand somewhat the pig's language; there is the constant grunting, which is a sound that keeps the pig herd together. We understand perfectly the complaining squeal of hunger, the satisfied grunt signifying enjoyment of food, the squeal of terror when seized, and the nasal growl when fighting. But there is much more to the pig's conversation than this; I know a certain lady, who is a lover of animals, and who once undertook to talk pig language as best she could imitate it, to two of

her sows when they were engaged in eating. They stopped eating, looked at each other a moment and forthwith began fighting, each evidently attributing the lady's remark to the other, and obviously it was of an uncomplimentary character.

The pig's ability to take on fat was evidently a provision, in the wild state, for storing up fat from mast that should help sustain the animal during the hardships of winter; and this character is what makes swine useful for our own food. Pigs, to do best, should be allowed to have pasture and plenty of fresh green food. Their troughs should be kept clean and they should have access to ashes, and above all, they should have plenty of pure water; and as the pig does not perspire freely, access to water where it can take its natural mud-baths helps to keep the body cool and the pig healthy in hot weather.

The breeds of hogs most common in America are the Berkshires, which are black with white markings, and have ears extending erect; the Poland Chinas, which are black and white with drooping ears; the Duroc-Jersey, which are red or chestnut with drooping ears; the Yorkshire and Cheshire, which are white with erect ears, while the Cheshire White is white with drooping ears. The Poland China and Duroc-Jersey are both pure American breeds.

References—Elementary Agriculture, Warren; Our Domestic Animals, Burkett; The Country Reader, Buchanan; Lives of Animals, Ingersoll; Types and Breeds of Farm Animals, Plumb; and the bulletins of the U. S. Department of Agriculture.

LESSON LXIX

The Pig

Leading thought—The pig is something more than a source of pork. It is a sagacious animal and naturally cleanly in its habits when not made prisoner by man.

Method—The questions in this lesson may be given to the pupils a few at a time, and those who have access to farms or other places where pigs are kept may make the observations and in giving them to the class they should be discussed. Supplementary reading should be given the pupils, which may inform them as to the habits and peculiarities of the wild hogs. Theodore Roosevelt's experience in hunting the wart-hog in Africa will prove interesting reading.

Bottle-fed babies.

Observations—1. How does the pig's nose differ from that

of other animals? What is it used for besides for smelling? Do you think the pig's sense of smell is very keen? Why do pigs root?

2. Describe the pig's teeth. For what are they fitted? What are the tushes for? Which way do the upper tushes turn? How do wild hogs use their tushes?

3. Do you think that a pig's eyes look intelligent? What color are they? Do you think the pig can see well?

4. Is the pig's head straight in front or is it dished? Is this dished appearance ever found in wild hogs? Do the ears stand out straight or are they lopped? What advantage is the wedge-shaped head to the wild hogs?

5. How is the pig covered? Do you think the hair is thick enough to keep off flies? Why does the pig wallow in the mud? Is it because the animal is dirty by nature or because it is trying to keep clean? Do the hog's bristles stand up if it is angry?

6. If the pig could have its natural food what would it be and where would it be found? Why and on what should pigs be pastured? What do pigs find in the forest to eat? What kind of bacon is considered the best?

7. On how many toes does the pig walk? Are there other toes on which it does not walk? If wading in the mud are the two hind toes of use? Do wild pigs run rapidly? Do tame pigs run rapidly if they are not too fat? Do you think the pig can swim? Do you think that the pig's tail is of any use or merely an ornament?

8. What cries and noises do the pigs make which we can understand?

9. How do hogs fight each other? When the boars fight, how do they attack or ward off the enemy? Where do we get the expression going "sidewise like a hog to war?"

10. How many breeds of pigs do you know? Describe them.

11. What instances have you heard that show the hog's intelligence?

12. Give an oral or written English exercise on one of the following topics: "The antiquity of swine; how they were regarded by the ancient Egyptians, Greeks and Romans;" (see encyclopedia). "The story of hunting wild hogs in India; "The razor-back hogs of the South;" "The wart-hog of Africa."

"*The nice little pig with a querly tail,*
All soft as satin and pinky pale
Is a very different thing by far
Than the lumps of iniquity, big pigs are."

—Nonsense Rhyme.